CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter discloses the direct, indirect and cumulative effects of the alternatives described in Chapter 2. The affected environment and methodology for analysis was addressed in Chapter 3.

DIRECT AND INDIRECT EFFECTS

Direct effects are caused by an action and occur at the same time and place. Indirect effects are caused by an action and occur later in time or farther removed in distance, but are still reasonably foreseeable.

Direct and indirect effects analysis for each alternative and each resource area are based on the description of the alternatives provided in Chapter 2, including the mitigation measures described under each alternative and under Features Common to All Alternatives section.

Also, every resource assumed that all acres indicated in Chapter 2 would be treated in each of the alternatives. Due to the way the inventory and mapping was done, treatment acres may be less than those indicated. This is mostly caused by areas of light or no weed infestation being included within a weed location "polygon" in the mapped database. The minimum size of a weed polygon is 0.01 acres, where the actual size might be one plant or a small patch.

SHORT TERM USE VS. LONG TERM PRODUCTIVITY

Unless otherwise specified, short-term effects are those that occur within three years after treatment. Long-term effects are those that occur in three to five years after last treatment.

IRREVERSIBLE / IRRETRIEVABLE

National Environmental Policy Act requires identification of irreversible and irretrievable commitment of resources. These effects are identified in resource areas where they may occur including soils, vegetation, and wilderness and Inventoried Roadless Areas.

ENVIRONMENTAL JUSTICE

No minority or low-income communities would be disproportionately impacted by any of the alternatives. Implementing any alternative would not alter opportunities for subsistence hunting by Native American tribes.

ENERGY REQUIREMENT

None of the alternatives being considered for this project have unusual energy requirements.

ADVERSE EFFECTS THAT CANNOT BE AVOIDED

There are no adverse effects associated with this project identified in the analysis that cannot be avoided. Environmental protection measures listed in Chapter 2, page 2-17, will be implemented and will mitigate any adverse effects from weed control.

CUMULATIVE EFFECTS

Cumulative impacts are impacts on the environment that result from the incremental impact of actions when added to other past, present, and reasonably foreseeable future actions. For each resource, an analysis area was identified and used to adequately measure cumulative effects of the proposed alternative. Unless otherwise stated, the cumulative effects area, or the geographic scope, is the treatment area. For temporal scope, the timeframe for project implementation is 15 years and an additional five years past the final implementation year is considered.

Past present and reasonable foreseeable activities

Weed control efforts including aerial and ground application of herbicides will continue on privately-owned and public lands with and adjacent to the Gallatin National Forest. Government agencies such as the National Park Service, Bureau of Land Management, Bonneville Power Administration, Beaverhead-Dearlodge National Forest, Lewis & Clark National Forest, Custer National Forest, Targhee National Forest, Montana Fish Wildlife and Park, Montana State University, Montana Highway Transportation Department, Montana State Public Lands, City of Bozeman, Gallatin County, Park County, Madison County, Sweet Grass County, Carbon County and Meagher County all use herbicides to control weeds adjacent to the Gallatin National Forest. Activities that alter vegetation and may potentially act as a weed vector such as wildfires, timber harvesting, fuel reduction, livestock grazing, and recreational uses (hunting, hiking, motorized recreation, etc.) will continue to dominate the landscape. The Forest Service has developed prevention and mitigation measures that minimized the impacts of these activities on weed spread (FSM 2080). The Best Management Practices for Weed Control is listed in Appendix A.

VEGETATION

This section is divided into three main categories (weed species, native plant and rare plants) and will evaluate the effects of the four alternatives along with the cumulative effects.

Weed Species, Direct and Indirect Effects - Alternative 1 (Proposed Action)

Under this alternative various pest management practices such as pulling, biological control, and herbicide treatment would be used in combination to control, contain and/or eradicate populations of weed species. Aerial application of herbicides is also provided, thus, larger or remote infestations can be treated in a safe, efficient, and economical manner. The most effective means for control and/or eradication would be chosen depending on the likelihood of long-term effectiveness or resource values at risk. Table 2-1 would generally guide actual treatment priority with emphasis generally being given to new invaders and species having the greatest risk of spread. For example, the Gardner Ranger District may collect enough funds to treat all of the priority 1, 2, and 3 sites but only a small portion of the priority 4 and 5 sites. At the same time, special funding may also become available that provides for treating a priority 5 site, knowing the control may be only temporary. An example might involve improving the winter range in an effort to pull wintering big game away from private lands.

This alternative provides for treatment of roughly 2,983 acres with a budget of $300,000 annually. Table 4-1 identifies the additional acreage that could be treated given additional funding. This alternative provides for the maximum treatment of 23.7 to 96.2 percent of the current weed base. A majority of the current weed sites are less than one tenth acre in size and still very manageable. In other words, treating the small satellite populations and keeping those priority weeds in "check" will limit spread into new areas. Aerial application of herbicides would occur on 255 acres or 2 percent of the current weed base. The Ranger Districts would reassess priorities from year to year with the intent of focusing efforts on those weeds most threatening resource values.

Table 4-1. Alternative 1 - Acres of Weed Treatment Based on Funding, Gallatin National Forest.

Ground Applied Herbicide	Aerial Application	Manual Hand Pulling	Biological Control	Cultural	Total Annual Treatments	Percent GNF Weed Base (12,600 ac)
2956	0.0	1	25	1.0	2983	23.7
5179	255	41	4985	2135	12595	96.2

Ground application of herbicides would be used on some 2,956 acres of weeds as the least cost effective means of control. Efforts to utilize the most selective herbicide would also be entertained.

This alternative provides for the use of a wide variety of herbicides that have a wide range of plant selectivity. Glyphosate is the least selective, affecting most plant species. Clopyralid is the most selective herbicide, affecting only plants in the sunflower (Compositeae), buckwheat (Polygonaceae), nightshade (Solanaceae), and pea (Fabaceae) families. Sixteen of the thirty existing Gallatin Forest weed species are in these families. The other herbicides fall between these two in their selectivity. Most affect all broad leaf plants but do not harm grass and grass-like species. All of the Gallatin National Forest weed species are broad-leaved species, except cheatgrass. Conifers have variable response to herbicides, but many are negatively affected by most herbicides. Application rate and extent of coverage, either spot or broadcast, can affect what plant species are impacted by the herbicides. Many of the species can be protected through following label application limits. The timing of application and rotation of herbicides may also be important in limiting impacts to non-target native vegetation. This alternative provides for two additional herbicide families to choose from that would not be used in Alternative 3. Rotating between three family groups of herbicides that are selective in nature will significantly limit potential damage to non-target native plants. Impacts to native plant communities and rare plant species can be greatly reduced while still controlling the weeds on the site.

Aerial application will greatly increase the efficacy of the weed control program on the larger, more remote sites. Weed densities can be greatly reduced through broad scale treatments. Ground crews will have more time to focus on the smaller, scattered infestation, prior to the weeds increasing to the point where control efforts become overwhelming. Aerial treatment is a valuable tool in areas where weeds become established on the steeper slopes or where terrain is a safety concern.

Manual control of areas ranging from 1 to 41 acres is anticipated each year on sites that have very few plants, and/or where the plants have already established viable seed before herbicide treatment occurs. Manual methods are very labor intensive and generally effective only on weed species that do not have extensive root systems. For treatment to be effective the site needs to be checked multiple times during the growing season to prevent weeds from going to seed. The site must also be treated yearly until the weeds are eradicated. This method is primarily used where a few plants exist, and in sensitive areas such as adjacent to open water or high water table sites. It is also used where threatened, endangered or sensitive plants species are present and other control methods would harm the rare species.

The biological control program on the Gallatin National Forest would be expanded to include new sites, when necessary, as a secondary form of control. The effectiveness of other control measures would limit the need for focusing much attention on the use of biological control agents. Coordination with Animal Plant Health Inspection Service (APHIS) and other affiliations to release and monitor current and new control agents would occur. Use of biological control agents would be focused on Table 2-1, priority 5 sites. The nature of biological control agents is to reduce density and seed production of the target weed, not necessarily to contain or eradicate the species. Multiple biological control agents that work on different parts of the plant tend to be more successful than relying on a single agent. Two weed species, leafy spurge and musk thistle, do have biological control agents that are showing promising results in reducing plant density and coverage.

Cultural control of at least one acre per year would also be encouraged. Efforts to convert cheatgrass communities to native bunchgrass communities would be given priority before the sites are converted to more aggressive perennial weed sites. Efforts to convert exotic plant communities back to native ecosystems would also be encouraged as native seed sources become readily available. Removing unwanted weeds would involve herbicidal control, possibly seedbed preparation, and seeding. The best seeding success involves drill planting and irrigating at least until vegetative stand establishment occurs.

Weed Species, Direct and Indirect Effects - Alternative 2 (No Herbicide)

This alternative does not rely on herbicides for controlling weed infestations. Manual, mechanical and biological control methods would be used to control weeds on the Gallatin National Forest. This alternative provides for the treatment of approximately 1,991 acres each year with a budget of $300,000. Table 4-2 identifies 15.8 to 74.6 percent of the current weed base being available for treatment. Manual methods of control are very labor intensive and generally effective only on weed species that do not have extensive root systems. Biological control agents would be the primary method used and this tool has had very limited effect on controlling the density of most weed species. At the present time, the Forest has found leafy spurge flea beetle effective in reducing the spurge density on some dry sites. Other biological control agents released on the Forest have not made a noticeable change in weed density. In the future as biological control agents become more abundant and other insects become available, then this may become a more effective tool.

Table 4-2. Alternative 2 - Acres of Weed Treatment Based on Funding, Gallatin National Forest.

Ground Applied Herbicide	Aerial Application	Manual Hand Pulling	Biological Control	Cultural	Total Annual Treatments	Percent GNF Weed Base (12,600 ac)
0.0	0.0	5	1985	1.0	1991	15.8
0	0	130	7622	2017	9769	74.6

Pulling can be effective on new infestations or very small sites with a low plant density. For treatment to be effective the site needs to be checked multiple times during the growing season to prevent the weeds from going to seed. The site must also be treated yearly until the weed is eradicated. Pulling would kill the individual plants that are removed so long as the entire root is taken. Pulling is not affective on species with extensive root systems, like those of leafy spurge or Canada thistle.

Mowing or use of a weed whacker can be used to prevent weed species from going to seed. This is a very long-term control method. If you can keep the weed from producing seed eventually the individual plants may die out. Again this is only for species that reproduce primarily by seed. Weeds with extensive root systems would not be affected. In fact many such species are stimulated to increase their root systems when their tops are cut. Control by mowing is similar to pulling; the site must be retreated multiple times during the growing season to prevent the plant from producing any seeds. The site also must be treated each year or the benefits of the previous years treatment is lost.

Manual methods can be affective in localized sites. However, even with the relatively small amount of weed infestations on the Gallatin National Forest it is impossible to make any meaningful control effort by the use of manual methods.

A variety of biological control agents are present on the Gallatin National Forest. Coordination with Animal Plant Health Inspection Service (APHIS) to release and monitor current and new control agents will continue. Use of biological control is the primary focus for weed control under this alternative. Biological control agents would be placed on some 1,985 to 7,622 acres each year with the intent of giving the agents every possible opportunity to do some good. The nature of biological control agents is to reduce the density and seed production of the target weed, not to contain or eradicate the species. At this time most biological agents have not shown significant effects on the majority of weed species. Two weed species, leafy spurge and musk thistle, do have biological agents that are showing promising results in reducing plant density and coverage. Currently no biological control agent has shown an ability to control or reduce the spread of any Gallatin National Forest weed species.

This alternative provides for 1,991 acres of treatment, the least of any alternative considered. Biological control agents could be released on all weed infestations, but until such time as they become effective at reducing the density and spread of these weeds no effective control is expected. The risk of weeds taking over a majority of the sites depicted in Table 3-5 becomes more probable.

The threat of herbicides impacting native plant communities is far exceeded by weeds displacing plants under this alternative.

Weed Species, Direct and Indirect Effects - Alternative 3 (No Change from Current Management)

This alternative would treat up to 1,162 acres currently approved for treatment with a budget of $300,000 annually. The primary differences between this alternative and Alternative 1 is that herbicide treatments would be restricted to ground based application, and would only use picloram and 2,4-D herbicides on pre-approved sites. This alternative provides treatment for 8.9 percent of the current weed base. Rapid spread of weeds on those sites not previously approved for treatment would occur.

Table 4-3. Alternative 3 - Acres of Weed Treatment Based on Funding, Gallatin National Forest.

Ground Applied Herbicide	Aerial Application	Manual Hand Pulling	Biological Control	Cultural	Total Annual Treatments	Percent GNF Weed Base (12,600 ac)
346	0	281	535	0	1162	8.9

Cultural treatments would not be provided for, most likely resulting in cheatgrass sites becoming infested with perennial weeds.

Weed Species, Direct and Indirect Effects - Alternative 4 (No Arial Application)

Direct and indirect effects of this alternative are similar to Alternative 1. The primary difference is all herbicide treatments would be restricted to ground based application. This alternative provides for treatment of 2,983 acres with a budget of $300,000 annually. Table 4-4 identifies the additional acreage that would be treated given additional funding. This alternative provides treatment for 23.7 to 95 percent of the current weed base. No aerial application of herbicides would be allowed. Biological control agents would be the primary control option in this alternative. The direct and indirect effects described in Alternative 2 would be the same for these sites.

Table 4-4. Alternative 4 - Acres of Weed Treatment Based on Funding, Gallatin National Forest.

Ground Applied Herbicide	Aerial Application	Manual Hand Pulling	Biological Control	Cultural	Total Annual Treatments	Percent GNF Weed Base (12,600 ac)
2956	0.0	1	25	1.0	2983	23.7
5179	0	41	5086	2135	12441	95.0

Weed Species, Cumulative Effects

Invasive weeds are an ongoing battle, especially where eradication isn't likely. The odds of having an effective eradication program improve drastically with treating weeds before they become established through seed reserves and/or extensive root networks. The adaptive management approach as designed in Alternatives 1 and 4 best provides for early detection and eradication. Biological control is a slow and long-term process, especially in Alternative 2 where it is the primary form of control. While biological control agents haven't successfully eradicated any one species on the Gallatin Forest they have soften the impacts significantly for some species such as Canada thistle.

Alternatives 1 and 4 would add to efforts ongoing by adjacent counties and ownerships to control weeds surrounding the Gallatin National Forest. Other landowners, including private and corporate owners, State, and others would benefit from reduced weed populations on the Gallatin Forest. Actions under these alternatives would allow the Gallatin Forest to work closer with surrounding landowners, counties, and other land management agencies to be more effective at controlling and containing weed infestations.

Under Alternatives 2 and 3, since the effectiveness of the weed control will be reduced, adjacent land owners will see an increase in weeds spreading from the Forest lands onto there lands over time.

Native Plant Communities, Direct and Indirect Effects - Alternative 1 (Proposed Action)

There is little doubt that measures taken to control weeds will kill some non-target, native plant species. It is important to note that although most weed control activities may kill some individual native plants, the action would be intended to prevent the far greater loss of species diversity resulting from further uncontrolled weed infestations. Impacts to plant communities are reduced when control actions are taken at an early stage of invasion. Affects on plant communities increase as weed infestations expand in size and density. The increased impacts come not just from the weeds but also from the control measures. When treatments must be broadcast across an entire area and not specifically focused on the target plant, control measures have a greater potential for negative impacts. This is true for manual, biological, and herbicide treatment methods.

Pulling target weeds has little affect on native vegetation. This is due primarily to the very limited area that can be affectively treated by this method and the fact that you are pulling just the target plant. Pulling may affect adjacent plant species due to soil disturbance when removing the entire root system. Significant soil disturbance is rare and generally only seen where weed densities are very high. Mowing may reduce the vigor and reproductive ability of native plant species, which are mixed in with target weeds. As the goal of mowing is to prevent weed species from producing viable seed, timing of the treatment can be used to reduce the impacts to native species. For either of these methods the extent of their use is very limited and the proportion of native plant populations affected would be very small.

Biological control agents are rigorously selected and screened to prevent impacts to non-target species. Not all native species are tested for each new agent. A few biological control agents released prior to the current, more stringent screening protocols, have been found to feed on native plant species. Their impacts have not fully been evaluated. In general, biological control agents are useful in native plant communities because they avoid other non-target vegetation. The Gallatin National Forest will rely on the updated screening process being followed for biological control agents. None-the-less, because of the remote possibility of effects to native plant species from biological control agents, the Forest will review decisions to release new agents on the Forest.

Use of herbicides has the highest potential to impact native plant communities. Herbicide use will kill non-target plants. The degree of mortality of native species depends on the herbicide used, and the application method, and rate and frequency. As discussed earlier the herbicides to be used range in their affects on plant species. Clopyralid is the most selective and glyphosate is a non-selective herbicide that will kill most plant species including grasses.

Of the proposed application methods, aerial application is most likely to affect non-target native plants. This is because this method indiscriminately applies herbicide to all plants in the treatment area. Also, drift can affect plants outside the treatment area. However, precautions would be taken to minimize drift. Spot applications with backpack sprayers, truck mounted sprayers or wick applicators focus the herbicide on the target weeds with limited treatment to adjacent non-target vegetation. These methods would affect native species the least.

Under this alternative, Integrated Pest Management strategy methods that would be most effective on controlling invaders, while minimizing impacts on native species would be used. This approach would help decrease the effects of herbicide use. In addition, as only a small portion of the overall infested areas would be treated, the impacts to common native plants are insignificant as they relate to species abundance, distribution, and population viability on the

Gallatin National Forest. Relative speaking, this alternative has the best odds of keeping those potential areas identified in at high risk from becoming weed infested.

This alternative will, in the short term, affect more native plants due to the broadcast application of herbicides by aerial application than the other alternatives. In the long tern this alternative will protect more native plants and plant communities because of the same actions. Being able to treat a large number of infested acres will greatly improve the probability of controlling many of the weed species currently found on the Forest.

Native Plant Communities, Direct and Indirect Effects - Alternative 2 (No Herbicide)

The negative affects of exotic species introduction have been well documented. A review of the many effects that invasive species impose on native plant and animal communities can be found in Sheley and Petroff (1999). In brief, exotic plant species can decrease plant diversity, structure and function in native plant communities by out competing native species for available resources. Exotics have also been known to displace rare plant species (Thompson *et al.*, 1987; Lesica and Shelly, 1996). Some invaders release secondary compounds or allelopathogens that can affect the establishment of native plant species. In addition, some believe that there are situations where the invasion of exotic species is second only to habitat destruction as the most important threat to biodiversity.

These changes in native species composition and structure can have severe impacts on wildlife populations by altering forage availability, reducing cover and eliminating breeding sites. These effects may be felt from invertebrates and soil microbes to the largest ungulate, which depend on native plants for forage.

Invasive weeds can decrease organic matter content and nutrient availability in soils and can increase soil erosion and infiltration. Some species can even increase the salinity of the soil.

Plant communities altered by invasion will not respond to historical disturbance regimes such as fire, insect and pathogens and wind and storm events as they once did. As noted earlier, we conducted a risk assessment on the Gallatin National Forest, which showed the vulnerability of lands subject to invasion of weeds. The analysis shows 27.8 percent or 500,000 acres of the Forest at high risk to weed infestations (see the project file, vegetation section). This is a significant portion of the land base. Furthermore, this acreage is not distributed evenly among the vegetation types. The higher elevation moist forest types are the least vulnerable to invasion, yet every acre of the low elevation non-forested communities is at risk. Although there is less acres of non-forest communities than forested, they comprise some of the more unique, species rich communities next to riparian and wetlands on the Gallatin National Forest. Once converted, these habitats may never be restored to their original condition.

This is not to say that the forest types would not be at significant risk as well. Early successional stages of forest community, those that are most vulnerable to invasion, could be altered to where early forest succession could be impacted. Tree seedlings may have difficulty becoming established, which in turn may alter the future composition and vegetative structure of the forest. These changes in early and mid-serial vegetative structure also effects the frequency and intensity of nature disturbance processes, such as fire and insect infestations.

With Alternative 2 there will be an increase of weed spread, and the consequences described above will occur on the lands identified at risk for the Gallatin National Forest.

Native Plant Communities, Direct and Indirect Effects - Alternative 3 (No Change from Current Management)

Direct and indirect effects of this alternative are similar to Alternative 1 for the 1,162 acres previously approved for treatment. The primary difference is all herbicide treatments would be restricted to ground based application. No aerial application of herbicide would be allowed. In addition, the only herbicides that would be available for use would be picloram, and 2,4-D. Restricting the use of herbicides would eliminate the option of rotating herbicides due to one of the two options being non-selective. This alternative would impact fewer native plant species or communities by the application of herbicides. This is because aerial herbicide application would not be allowed. The number of acres that can be treated by ground-based application is limited in extent, due to terrain, personnel, and time constrains. Impacts to native plant communities will come more from the continued spread of weed species than the loss of non-target plants to herbicides. Relatively speaking, this alternative protects the native plant communities better that Alternative 2 but not as good as Alternatives 1 and 4.

Native Plant Communities, Direct and Indirect Effects - Alternative 4 (No Arial Application)

Direct and indirect effects of this alternative are similar to Alternative 1. The difference being some of the higher valued lands treated in Alternative 1 with aerial herbicide application would now be treated with biological controls only. Thus, these sites become established with weeds quicker and provide a larger seed source for other sites. Further effects to those areas not permitted aerial treatment will be comparable with those in Alternative 2.

Native Plant Communities, Cumulative Effects,

In addition to the native species that would possibly be killed under Alternatives 1 and 4, other ongoing actions such as timber harvest, grazing, recreational use, mining and harvest of alternative forest products would also kill native plants. Although non-target plants will be affected from the use of herbicides, there is far greater potential loss of these native species and their habitats if nothing is done

With Alternatives 2 and 3 the trend of increasing infestations on the Gallatin National Forest lands are likely to also occur on adjacent private lands used for agriculture, lawns, grazed, pastured and developed commercially. These alternatives would compound this problem by making greater acreage on public land available for invasion. Although most infestations do not originate on the Gallatin National Forest, there are cases where invasions originate on Forest lands and could potentially move out to invade private lands. In many cases, if the Forest Service fails to actively treat weeds then adjacent landowners will do the same.

Rare Plants, Direct and Indirect Effects Common to all Alternatives

Currently there are six sites that have invasive weeds immediately adjacent to rare plants. The amount of impact that the weeds will have on the rare plants will depend on plants physical characteristics. For example, *Salix wolfii* is a shrub that forms a dense canopy that will grow taller and thicker than the weeds. In this situation, the weeds will not detrimentally impact the willow, because most weeds will not survey in dense shade.

On a different site that has both *Balsamorhiza* (which has a root tuber) and Canada thistle (which spreads by both wind disseminated seeds and rhizomes) there may be a considerable amount of competition between the two species. Canada thistle has the ability to spread quickly and for thick patches that can exclude native plants. Since *Balsamorhiza macrophylla* is known to occur on only two sites on the Forest, effort should be made to prevent Canada thistle from out-competing the *Balsamorhiza*. Treating the weeds by using the mitigation measures listed above will protect the sensitive plant from both the Canada thistle and herbicide treatment. Also, to help protect the *Balsamorhiza macrophylla* on this site, periodically inspect the area for the presence of invasive weeds. Treatment efforts are more effective and less disruptive when only treating a few weeds. If Canada thistle or other invasive weeds become well established, then the treatment will be detrimental to the *Balsamorhiza macrophylla*. Do not treat the weeds if the treatment will negatively impact the rare plant.

There are two sites one with *Haplopappus macronema* and the other with *Castilleja gracillima* that are at risk of being invaded by yellow toadflax, spotted knapweed, and scentless chamomile. In numerous locations throughout the Hebgen Basin yellow toadflax has formed dense patches to the point of excluding native plants. Since these invasive plant species are very aggressive it is reasonable to conclude that these sensitive plants might be out-competed by invasive plants. Sites with native plants need to be protected from invasive plants by treating the weeds and preventing further spread of weeds (use Best Management Practices, FS Manual 2080). The mitigation measures listed above will protect the sensitive plants from herbicide or hand grubbing treatments.

The last site has *Castilleja gracillima* and houndstounge. Since *Castilleja gracillima* is rhizomatous, and houndstoungue has a taproot, and both plants have similar size; it is reasonable to assume that the *Castilleja* will compete well with the houndstoungue and is not at risk. Also, houndstongue can be controlled by cutting-off the flower stock when working within 50 feet of the sensitive plant. Consequently, at this site, neither the invasive plant nor the treatment will impact the sensitive plant.

In addition, the Horse Butte area and the Hebgen Damn have *Mimulus nanus* and possibly *Mimulus breviflorus*. Although these plants are not currently on the Gallatin National Forest Sensitive Plant list, they are listed as species of concern in Montana according to the Montana Heritage Program (http://nhp.nris.state.mt.us/plants/index.html). Regardless of the legal status, these plants will be protected from both invasive plants and control methods.

- Use the control method with the least impact on the rare plant (pull or cut the weeds if this is an effective control method and will not damage the rare plants);
- Use a herbicide that will not leach through the soil;
- Protect the rare plant from herbicide drift.

Mitigation Common to all Alternatives

The following mitigation measures will reduce the risk of damage to sensitive plants:

- Use the control method with the least impact on the rare plants (for example, pull the weeds if the roots of the rare plant will not be detrimentally affected by the soil disturbance);
- Do not broadcast spray (including aerial treatment) herbicide within 100 feet of a sensitive plant;
- When applying herbicides within fifty feet of a sensitive plant, use a herbicide that does not leach in the soil (for example glyphosate) and protect the sensitive plant from herbicide drift (for example cover plant with plastic when spraying herbicide or use a wick applicator).

Rare Plants, Direct and Indirect Effects - Alternatives 1 and 4

Since the effects of Alternatives 1 and 4 are the same with respect to sensitive plants, these two alternatives will be addressed together. The risk with these alternatives is that herbicides will accidentally be sprayed on sensitive plants. However, with the following mitigation measures this risk is very low.

- Complete a sensitive plant survey prior to treating sites.
- Provide the weed crew with maps of all known sensitive plants so that these sites can be identified and protected.
- Train the weed crew to identify sensitive plants so that new sites can be identified and protected.
- If sensitive plant surveys find invasive plants in the area, a weed control plan will be developed to help protect the sensitive plant.
- Implement the Noxious Weeds Best Management Practices (FS Manual 208) to help prevent the spread of invasive plants.
- When using herbicide treatments within 100 feet of sensitive plant (including aerial spray), do not broadcast spray.
- When treating weeds within 50 feet of sensitive plants: pull the weeds if the soil disturbance will not harm the sensitive plant; use herbicides that do not leach in the soil (glyphosate); applying herbicide when the sensitive plant is senescent, or protect the sensitive plant from herbicide drift by placing a physical barrier (such as a plastic bag) over the sensitive plant, or use a wick application to apply the herbicide directly on the weed so mist is not created.

Adaptive Management for Treating New Sensitive Plant Sites

Over time new sensitive plant sites will be discovered and new plants will be added to the sensitive plant list. The following section will explain how each alternative will treat new sites.

In the No Change from Current Management Alternative 3, new sites or new sensitive plants will not be treated because they are not covered in the 1987 EIS.

In the No Herbicide Alternative 2, new sites and new sensitive plants will be treated if the treatment will not have a detrimental impact on the sensitive plant. Treatment will not include herbicides, and only use pulling provided that the ground disturbance will not impact the sensitive plant. In situations where the weeds spread by roots these sites will not be treated so the weeds will not be controlled.

For Alternatives 1 and 4, consider the following variables when developing a control strategy: 1) Look at the life cycle of the weeds and the rare plants to determine if the weeds will have an adverse impact on the rare plants. For example, a rare plant that is a tall shrub may not be threatened by low growing weeds that are biennial, but could be threatened by a vine that grows over the tops of other plants; 2) Consider the life cycle of both the weeds and rare plants when developing a control strategy to ensure that an effective control method is being used and is not detrimental to the rare plants. For example, a rare plant that is a shallow rooted annual may be impacted by the ground disturbance from pulling of weeds. A better control method in this case might include the clipping of the seed heads of the invasive weeds to keep new weeds from establishing. In some situations the weeds will spread via roots and will out compete the rare plants overtime. Clipping the seed head of weeds that have rhizomatous root systemswill not prevent the weeds from displacing the rare plants, and the use of herbicides may be the most effective control method; 3). If herbicides are used in the vicinity of rare plants adhere to the following mitigation measures: do not broadcast spray (including aerial treatment) herbicide within 100 feet of a sensitive plant; when selectively applying herbicides within fifty feet of a sensitive plant, use a herbicide that does not leach in the soil (for example glyphosate) and protect the sensitive plant from herbicide drift (for example cover plant with plastic when spraying herbicide or use a wick applicator). Regardless of the control method that is selected, if the control method is believed to have a detrimental impact on the rare plants, then it will not be used.

Rare Plants, Direct and Indirect Effects - Alternative 2 (No Herbicides)

With this alternative the known sensitive plant sites can be protected from invasive plants provided that the invasive plant can be pulled or has an effective biocontrol agent. Unfortunately, not all of the invasive plants that are present on the six known sites (the sites with sensitive plants) can be effectively pulled (for example, weeds that are rhizomatous such as with Canada thistle and yellow toadflax) and none of these weed species currently have effective biocontrol agents. On these sites the invasive plants will continue to spread. Due to limited funding, hand grubbing can only be implemented on a limited number of acres. Also, grubbing plants that spread via roots requires excavating the soil, which is detrimental to the sensitive plant. Due to the limited methods of control, this alternative will offer very little protection to the known sensitive plant sites from invasion from exotic plants. Only two of the six sites (Red Canyon and Dudely Creek areas) will be protected from invasive species; the other sites will not be protected.

Rare Plants, Direct and Indirect Effects - Alternative 3 (No Change from Current Management)

With this alternative none of the known sensitive plant sites will be protected from invasive plants because these sites were not identified in the 1987 EIS for treatment. Currently the Gallatin Forest has six sites that have invasive plants near sensitive plants. The invasive plants would not be treated and would continue to compete with the sensitive plants for sunlight, soil nutrients and water.

Rare Plants, Cumulative Effects

Spatial Boundary: The boundary for this analysis is limited to the Gallatin National Forest and some of the adjacent lands (private and federal). The boundary follows topographic features (such as streams, and ridges), and roads (see the map in project file, rare plants section). These features are physical barriers that allow for more effective weed control.

Temporal Boundary: Includes all known sensitive plant locations that have been identified within the last 10 ten years and all reasonably foreseeable activities that may impact these locations over the next five years.

The following activities are within the spatial and temporal boundaries, and are included in the cumulative effects analysis: weed control effort on land adjacent to the Gallatin National Forest; and other activities on the Gallatin National Forest that contribute to the spread of weeds near sensitive plant locations (such as timber harvest, prescribed and natural fires, recreation sites, and grazing).

First, if adjacent landowners do not control their weeds there is a risk that the weeds will spread to the National Forest and impact sensitive plants. Since Alternatives 1 and 4 are more efficient in controlling the spread of invasive plants, these alternatives would be able to respond to this type of situation with a more effective weed control program. Alternatives 2 and 3 would not be able to stop the spread invasive plants, because the tools are less effective (biological control agents are only effective on a few plants and pulling rhizomatous plants is detrimental to sensitive plants) or the location was not included in the 1987 environmental analysis so would not be treated (i.e., the No Action Alternative 3). If the weeds are being controlled on adjacent lands there is slight risk that the herbicides will impact the sensitive plants on the Gallatin National Forest. Most of the rare plants are more than 50 feet from the boundary and the herbicide is not likely to move this distance (either by drifting or by leaching) at concentrations that are lethal to the sensitive plants.

Second, other activities such as timber harvest, prescribed fires, recreation sites, and grazing may impact the spread of invasive plants and inadvertently impact sensitive plants. Prior to implementing all activities a sensitive plant survey and a weed risk assessment would be completed. The activities would be modified to mitigate the impact to the sensitive plants or the risk of spreading weeds. Also, the Best Management Practices for Noxious Weeds (FS Manual 2080) list activities that will be incorporated into the management of these activities to help prevent the spread of weeds. Since Alternatives 1 and 4 are more efficient in controlling the spread of invasive plants, these alternatives would be better able to control the spread of weeds. Alternatives 2 and 3 would not be able to stop the spread of invasive plants, because the tools are less effective (biological control agents are only effective on a few plants and pulling rhizomatous plants is detrimental to sensitive plants) or the location was not included in the 1987 environmental analysis (the No Action Alternative 3) so it would not be treated.

Biological Evaluation Determinations

Table 4-5 provides the determination of effects to sensitive plant species listed for the Gallatin National Forest that may occur in the analysis area. All alternatives have the risk of impacting an individual patch of rare plants (either from the weeds out-competing the rare plant or from accidental herbicide damage). At the same time, none of the alternatives will contribute towards federal listing because the plants are located in a number of different sites and the probability of impacting all sites is very unlikely. Determinations are based on the following:

NI	No impact
MIIH	May impact individuals or habitat but will not likely contribute to a trend towards listing or loss of viability to the population or species
WIFV	Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species*
BI	Beneficial impact

Table 4-5. Determinations of effects of Alternative 1, 2, 3 and 4 to sensitive plant species.

Alternatives/Species	1 Proposal	2 No Herb.	3 No Action	4 No Aerial	Statement of Rationale
Musk-Root	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Small-flowered Columbine	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Large-leaved Balsamroot	MIIH	MIIH	MIIH	MIIH	Suitable habitat present. Populations observed and effects were mitigated.
Pale Sedge	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.

Alternatives/Species	**1 Proposal**	**2 No Herb.**	**3 No Action**	**4 No Aerial**	**Statement of Rationale**
Slender Indian Paintbrush	MIIH	MIIH	MIIH	MIIH	Suitable habitat present. Populations observed and effects were mitigated.
Small Yellow Lady's Slipper	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
English Sundew	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Spike Rush	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Giant Helleborine	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Cotton Grass	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Hiker's Gentian	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
N. Rattlesnake Plantain	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Discoid Goldenweed	MIIH	MIIH	MIIH	MIIH	Suitable habitat present. Populations observed and effects were mitigated.
Hall's Rush	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Austin’s Knotweed	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Jove's Buttercup	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be effected by action alternatives.
Barratt's Willow	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Wolf's Willow	MIIH	MIIH	MIIH	MIIH	Suitable habitat present. Populations observed and effects were mitigated.
Shoshonea	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Alpine Meadowrue	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.
Calif. False-helleborine	MIIH	MIIH	MIIH	MIIH	Suitable habitat may be present. Habitat will not be affected by action alternatives.

Irreversible and Irretrievable Commitment of Resources to Vegetation

Implementation of Alternatives 1 or 4 with appropriate mitigation measures and site rehabilitation would result in no irreversible or irretrievable loss of native plant communities. Currently, native plant communities are more at risk from invasion and displacement by invasive weed populations. Implementing Alternatives 2 or 3 could result in irretrievable impacts to native plant communities on some areas if noxious weeds spread from untreated areas and dominate large areas that cannot be treated under existing policies and methods of weed control. With Alternatives 2 or 3 weeds would continue to proliferate and control measures would not be sufficient to prevent continued expansion of weeds and associated losses in native plant communities.

Consistency with Forest Plan and other Laws, Regulations and Policies to Vegetation

All alternatives would be consistent with direction in the Forest Plan and other laws regarding weed control.

SOILS AND GROUND WATER

Direct and Indirect Effects to Soils and Ground Water

Herbicides vary in their persistence in the environment and in their ability to move through the soil, and can pose an unintentional threat to groundwater quality. This analysis incorporates a hazard rating system known as Relative Aquifer Vulnerability Evaluation (RAVE) and GIS data (soil types, proximity to water, location of weeds) to determine area at risk. See the Soil and Ground Water section in Chapter 3 for a more detailed discussion on the methodology used to analyze this issue. The results from the analysis are presented below.

Table 4-6 shows RAVE risk classes for the entire Forest, and Table 4-7 proportions classes by Ranger District. Figure 1 (in Appendix E) shows areas at risk for the entire Gallatin Forest. Table 4-8 depicts areas of existing weeds (from the Gallatin National Forest Invasive Species Inventory) intersected with the "High" risk areas from the RAVE model. Table 4-9 shows total "High" risk by watershed and total area of existing weeds intersected with those "High" areas. Highlighted watersheds are those having greater than 640 acres of "High" areas. Watersheds with an asterisk (*) have more than 20 acres of existing weeds within those "High" areas. Figure 2 (also in Appendix E) shows risk areas and "High" risk weed infestations displayed by watershed.

Table 4-6. RAVE Risk Classes for the Entire Forest.

RAVE Score Class	Acres
Low to Moderate	1,994,893
High	105,353
Total	2,100,246

Table 4-7. RAVE Risk Classes by Ranger District.

DISTRICT	RAVE Score Class	Acres
Big Timber RD	Low to Moderate	378,334
	High	7,868
Bozeman RD	Low to Moderate	538,327
	High	17,065
Gardiner RD	Low to Moderate	351,429
	High	64,016
Hebgen Lake RD	Low to Moderate	324,604
	High	13,143
Livingston RD	Low to Moderate	402,185
	High	3,261
Total		2,100,232

Table 4-8. Percentage of Existing Weed Area by Risk Class for the Forest.

RAVE Score Class	Acres	Percentage of Total Existing Weed Area
Low to Moderate	4,555	92
High	394	8
Total	4,949	100

Table 4-9. High RAVE Risk Class by HUC6 Watershed (Acres in Risk Class and Acres of Risk Class In Weed Areas) If the HUC is not listed then no acres of "High" Rave Class existed

HUC6	HUC6 Name	Acres rated as "HIGH" RAVE Class	Acres rated "HIGH" in existing weed areas	High Risk Areas (gt 640 acres of "High" RAVE risk)	High Weed Occurrence in High Risk Area (gt than 20 acres)
100700060101	Broadwater Fisher	16,769		x	
100700060104	Russell	16,184		x	
100700060105	Beartooth	13,564		x	
100700010705	Upper Slough	5,128		x	
100200071601	Cherry	2,987		x	
100700020801	Rainbow	2,677	0	x	
100200070205 *	Denny	2,674	25	x	x
100700060103	Clarks Fork	2,496		x	
100200070306	Tepee	2,133		x	
100700010706	Lower Slough	1,851		x	
100200071401	Bear Trap	1,786		x	
100200080104	Bacon Rind	1,438		x	
100700010806	Crevice	1,331		x	
100700010702	Soda Butte	1,185		x	
100200080504	Twin	1,180	0	x	
100700010805	Lower Hellroaring	1,114		x	
100200070505	Hebgan Lake	1,076	19	x	
100700020804	Upsidedown Bridge	1,053	8	x	
100700030201	Shields Headwaters	899		x	
100700060107	Beartooth Lake	867		x	
100700010708	Buffalo	862		x	
100700020809	Upper East Boulder	858	2	x	
100200080604	Squaw	842	8	x	
100200080502	NF Spanish	807		x	
100700020808	Middle Boulder	782	2	x	
100200080107 *	Upper Taylor	752	25	x	x
100200080901	Hyalite	712	11	x	
100200070603	Lower Beaver	661	6	x	
100700020905	Lower West Boulder	658	1	x	
100700010802	Upper Hellroaring	648		x	
100200070304	Duck Red Canyon	642	14	x	
100200070202	Upper Madison	620	10		

HUC6	HUC6 Name	Acres rated as "HIGH" RAVE Class	Acres rated "HIGH" in existing weed areas	High Risk Areas (gt 640 acres of "High" RAVE risk)	High Weed Occurrence in High Risk Area (gt than 20 acres)
100200070204 *	S. Fk.Madison	619	29		x
100700020102	Mulherin	544			
100200081102	Boswick M Cottonwood	529			
100700030202	Smith	496	1		
100200080406	Dudley Levinski	495			
100200070305	Greyling	479	11		
100700021101	Upper Lower Deer	444			
100200080605	Cascade	436	5		
100200080103	Headwaters Gallatin	427			
100200080108	Wapiti	423	3		
100200080703	S Cottonwood	412			
100700020101	Cinnebar	405	0		
100200080302	Middle FK West Gallatin	398			
100700010803	Middle Hellroaring	352			
100200080803	Bozeman	346	18		
100700030301	Brackett	335	1		
100200070601	Upper Beaver	335	3		
100200080601	Portal	319	4		
100700020105	Upper Tom Miner	317	8		
100700020305a *	Lower Mill	305	29		x
100700020301b	Rock	295			
100700020301a	Upper Mill	294			
100200080501	SF Spanish	272	4		
100700020904 *	Middle West Boulder	256	52		x
100200081003	Reese	252			
100200080407	Deer Aspestos	236	0		
100700020302b	Passage	226			
100700010804	Horse	216			
100200080405	Porcupine	204	0		
100200080303	West FK West Gallatin	195			
100200080603	Swan	194	2		
100200080602 *	Moose Tamphry	194	60		x
100200080106	Sage	180			
100200080404	Beaver	179	0		
100200080804	Bridger Canyon	177			
100700020803	Meatrack	172	15		
100402010601	American Fork	169			
100700030101	Fairy Carrol	165	1		
100700020810	Lower East Boulder	163			

HUC6	HUC6 Name	Acres rated as "HIGH" RAVE Class	Acres rated "HIGH" in existing weed areas	High Risk Areas (gt 640 acres of "High" RAVE risk)	High Weed Occurrence in High Risk Area (gt than 20 acres)
100200081004	Quagle	162			
100200080802	Bear Canyon	137			
100301010302	S FK Sixteen mile	123	0		
100200080606	Hellroaring	116			
100200080801	Jackson Meadow	116	0		
100700020712	Swamp	114			
100200080402	Elkhorn	113			
100700030402	Cottonwood	108			
100700020302a	Upper Big	107			
100200081002	Pass Mill	105	0		
100200070203	Dry Canyon	105	1		
100700021202	Lower Sweetgrass	104			
100700020303a	Lower Big	101	1		
100700021302	West Bridger	96			
100200080701	Yankee Wilson	90			
100700030408	Willow	75	11		
100700030403	Rock	74			
100700020714	Big Timber	73			
100700020304a	Donahue Daily	62	0		
100200080401	Buffalo Horn	60			
100700020406	Suce Strickland	58	0		
100700020713	M FK Big Timber	57			
100700030406	Bangtail	57			
100700020306	Emigrant	53			
100200070602	Cabin	52			
100200080505	Wilson Draw	51			
100700020807	Shorty	49	0		
100200080702	Big Bear	44			
100700020711	Little Timber	43			
100700021001	Otter	37			
100700020402	Trail	36			
100200080403	Buck	35			
100700020108	Sphinx Slip and Slide	35	0		
100700020906	Boulder	35	0		
100700020307	Fridley	31			
100700030104	Lower Flathead	29			
100700020309	Pole Conlin	28			
100700020305b	Sixmile	25			
100700030405	Canyon	25			
100200081103	Sypes	23			
100700020106	Horse	21			

HUC6	HUC6 Name	Acres rated as "HIGH" RAVE Class	Acres rated "HIGH" in existing weed areas	High Risk Areas (gt 640 acres of "High" RAVE risk)	High Weed Occurrence in High Risk Area (gt than 20 acres)
100700020903	Blacktail	19			
100700020403	Pine West	13	2		
100700020303b	West Fork Mill	13			
100700020505	Mission	13			
100700020308	Eightmile	12			
100700030204	Porcupine1	8			
100700030102	Upper Flathead	6			
100700030205	Elk	4			
100700021201	Upper Sweetgrass	3			
100700020811	Lower Boulder	2			
Total		102,649	392		

Though all the factors discussed above influence rating scores, it appears that depth to groundwater and pesticide leachability account for most of the "High" ratings. Though this model is designed for a programmatic planning level, and is not appropriate for on-site design, the data depicted in Figure 1 (in Appendix E) is accurate enough to use on a district level if mapped at that scale. This analysis also provides useful "red flag" indicators for applications specialists when in areas designated "High" risk.

For the case using a highly-leachable herbicide, almost all of the Gallatin Forest falls in the "low to moderate" risk class. Only five percent falls in the "High" class (Table 4-6.) This indicates that as far as groundwater contamination is concerned, careful use of herbicides on most lands on the Forest is likely a reasonable activity. There are "hot spots" in each Ranger District where special mitigation measures should be considered (Figure 1 in Appendix E). The Gardiner District has the most area in this class (Table 4-7), primarily due to the high elevation area near Cooke City.

In any of these areas, use of an alternate herbicide with a low leaching index should reduce risk to reasonable levels. High-risk areas average a score of 75. Selecting an alternative herbicide with a low leachability (in Appendix E) giving a rating factor value of 5 rather than 20. This lowers the average score to 60, well within the "Low to Moderate" risk class (Table 3-8.)

Figure 2 (in Appendix E) shows there are some watersheds that should be reviewed for risks of groundwater contamination, based on the potential for contamination through existing weed infestations and potential future contamination if weeds are found in or migrate to those areas. These watersheds are listed in Table 4-9. The watersheds having existing weed infestations in "High" risk areas should have special mitigation measures designed into all current treatment plans.

Although only a small portion of weeds fall into the "High" risk areas (Table 4-8), there are some areas of specific concern. Watersheds having both a significant area in "High" risk and a significant area of weeds in those "High" risk areas should use herbicides that have low leaching potential. Watersheds of "Low to Moderate" risk can be evaluated at a less intense level. In terms of long term planning, watersheds having few weeds, but some potential for contamination should include prevention and weed surveys at a higher level than other watersheds to prevent the establishment of weeds into those areas. For example, the Cooke City area (Figure 2 in Appendix E) has few weeds at present. However because of shallow groundwater and abundant surface water, the area should be specified for special mitigation measures (e.g. using herbicides of low leachability) as well as increased preventative measures such as travel restrictions or washing guidelines for vehicles.

Generalizing from the above discussion, it appears that under Alternatives 1 and 4 the Gallatin Forest has a low to moderate potential for groundwater contamination from foliar-applied herbicides. The areas of higher risk probably can be mitigated with herbicide selection to minimize that contamination potential.

A positive effect of Alternatives 1 and 4 is that weed incidence on the Forest will be reduced. The removal of exotic species is generally beneficial for the soil-part of the ecosystem and there should be beneficial effects here.

Alternatives 2 and 3 will not use herbicides in areas at risk to ground water contamination so there is no associated risk. However, the weeds will continue to spread under these alternatives and this will eventually lead to a reduction in soil productivity as has been documented in the Beaverhead-Deerlodge Noxious Weed Control EIS and in the Helena National Forest Weed EIS (USFA, 2002; USFS; 2003).

Cumulative Effects to Soils and Ground Water

Other foreseeable actions include treatment of weeds by other agencies or by private landowners within these areas at risk to ground water contamination. Although directions on herbicide labels prohibit applying herbicide in areas at risk to ground water contamination, people have not always followed these directions and there is always the risk of an accidental spill in an area with a high water table. However, with this analysis the areas at risk are easily discernable and herbicides that leach rapidly into the soil and aquifer will not be used in these areas. Given the mitigation measures there is a very low risk of ground water contamination from multiple applications of herbicides (either from multiple application within a HUC or over many years of continuous treatments).

Irreversible and Irretrievable commitment of Resources - to Soils and Ground Water

No irreversible or irretrievable commitment of soil or ground water resources is expected to result from any of the alternatives. Mitigation measures are in effect to control long-term impacts from herbicide treatments: consequently, Alternatives 1 and 4 will not impact these resources. Alternatives 2 and 3 will not effectively control the spread of weeds so there will be an irreversible loss of soil productivity.

Consistency with Forest Plan and other Laws, Regulations and Policies to Soils

As each alternative provides some measure of weed control, they are consistent with the Forest Plan standard, which states that management activities would be planned to sustain site productivity. They are consistent with the Soil Conservation and Domestic allotment Act (16 USC 590), as they limit decreases in soil productivity and suppress sedimentation. These alternatives are also consistent with 43 CRF § 1901 and MCA 76-13-101 which authorize land supervisors to manage vegetation in a way that reduces soil erosion. Additionally, preventing weed propagation is consistent with the Montana County Noxious Weed Management Act.

WATER QUALITY, FISHERIES, AND AMPHIBIANS

Direct and Indirect Effects - Alternative 1 (Proposed Action), Water Quality, Fisheries, And Amphibians

Results from the analysis (as described in Chapter 3) indicate treatments proposed for weeds within 17 of the 108 , 6th code HUCs (Hydrologic Unit Codes) across the Forest, show some risk for exceeding "safe" concentrations in surface waters (Table 4 -10).

Table 4-10. Gallatin National Forest watersheds (6th code HUCs) that show some risk for exceeding 'safe' concentrations of picloram.

District	HUC Name	HUC Number	Restriction
Hegben Lake	Upper Madison	100200070202	Do not exceed 90 lbs Active Ingredient
Hegben Lake	SF Madison	100200070203	Do not exceed 29 lbs Active Ingredient
Hegben Lake	Denny	100200070205	Do not exceed 81 lbs Active Ingredient
Hegben Lake	Duck Red Canyon	100200070304	Do not exceed46 lbs Active Ingredient
Hegben Lake	Hegben Lake	10020007050	Do not exceed 69 lbs Active Ingredient
Hegben Lake	Lower Beaver	100200070603	Do not exceed 36 lbs Active Ingredient
Hegben Lake	Sheep	100200070801	Do not exceed 15 lbs Active Ingredient.
Bozeman	Moose Tamphery	100200080602	Do not exceed 22 lbs Active Ingredient
Bozeman	Logger	10020008060	Do not exceed 22 lbs Active Ingredient
Bozeman	Bozeman	100200080803	Do not exceed 62 lbs Active Ingredient
Bozeman	Beasley M	100200080805	Do not exceed 30 lbs Active Ingredient
Bozeman	SF Sixteenmile	100301010302	Do not exceed 55 lbs Active Ingr edient
Gardiner	Sphinx Slip and Slide	100700020108	Do not exceed 57 lbs Active Ingredient
Gardiner	Eagle Reese	100700010902	Do not exceed 56 lbs Active Ingredient
Livingston	Deep	100700020108	Do not exceed 36 lbs Active Ingredient
Livingston	Donahue Daily	100700020304a	Do not exceed 32 lbs Active Ingredient
Livingston	Lower Mill	100700020305a	Do not exceed 46 lbs Active Ingredient

Direct Effects**:** Potential direct effects to aquatic organisms from noxious weed management are largely associated with the herbicide application on and around streams, lakes or other water bodies. Contamination can occur through direct herbicide contact with surface water (by either inadvertent application or accidental spill), or by herbicides leaching through the soils into groundwater. It may also occur when herbicides are applied intentionally or accidentally to ditches, irrigation channels, or are carried away in runoff to surface waters. Each route of entry results in varied magnitude and duration of contamination. Aerial spraying near aquatic zones has the most potential to expose aquatic organisms to contaminants, either through direct application or drift. Herbicides from ground-based equipment may also enter streams directly or through drift. However, the risk of contamination is reduced because application occurs more slowly and applicators are able to immediately recognize problems and adjust application techniques.

Introduction via overland flow is a consideration for some herbicides. Risks vary with the persistence of active ingredients, soil composition and characteristics, and the intensity and timing of precipitation events after herbicide application. Overland flow occurs infrequently on most well vegetated forests and rangelands because soil infiltration capacity is usually greater than precipitation. However, denuded and compacted soil typically provides increased potential for surface runoff. Mobilization in ephemeral stream channels is also a possible mechanism for herbicide entry to streams. Ephemeral stream channels may be difficult to see from the air and may be sprayed inadvertently. Ground application provides greater opportunity for identifying and avoiding these areas. Leaching through the soil profile can occur, but generally poses the least risk to aquatic environments. While there are exceptions, most herbicides disappear quickly from both the ground surface and soil. Reduced potential for leaching is largely facilitated by plant uptake of the herbicide, natural decomposition and volatilization of active ingredients, and/or adsorption of the herbicide by soil particles. Most groundwater contamination by herbicides results from point sources, such as spills, leaks, storage and handling facilities, improperly discarded containers, or rinsing equipment in loading and handling areas. Point sources are discrete, identifiable locations that discharge relatively high local concentrations of herbicides. Such problems can be avoided through proper calibration and rinsing and cleaning equipment.

Of the herbicides proposed for Gallatin National Forest use, picloram has the greatest potential to impact aquatic fauna. It persists longer than other chemicals considered, is slightly to moderately toxic to aquatic organisms, and is currently being used to control weeds on the Gallatin National Forest. Using the analysis procedures outlined above, extreme concentrations of picloram would never occur during Gallatin National Forest weed spraying activities, unless a spill occurred directly into a stream. However, proposed treatments may still result in small amounts of herbicide entering water. The analysis indicates herbicide applications in all but a few 6th code HUCs on the Forest should remain well below “safe” concentrations and pose little risk to fisheries (Table 4-10). This assumes that project implementation and mitigation measures described in the EIS are followed.

By following restrictions noted above (Table 4-10), instream concentrations should remain below 0.12 ppm and negative impacts to sensitive or Management Indicator Species aquatic species should not occur, since mitigation measures defined in Chapter 2 provide significant protection and all standardized values used in the model were extremely conservative.

The likelihood that an isolated, intense storm would occur right after extensive herbicide application and center itself on the treated area is very low. Observation of weather forecasts is required prior to aerial application. Using weather forecasts to guide herbicide application should effectively reduce the concentrations delivered to streams by another 10 to 50 percent, provided forecasts are relatively accurate for at least 2 or 3 days. Based on results from Watson, Rice and Monnig (1989), photo-decay of picloram ranged from 22 to 44 percent within seven days. The following rational further supports the likelihood that impacts to aquatic species within those HUCs will be avoided.

1) Most range and forest lands represent infiltration dominant sites rather than overland runoff sites. The model was standardized to say that 50 percent of every treated weed site is run-off dominant.
2) A six percent delivery of herbicide during overland runoff events represents the upper end of rates documented in the literature.
3) A 300-foot buffer maintained for aerial spraying will serve to intercept water and provide an additional infiltration area should precipitation events occur.
4) Stream flows increase as they travel down drainage, decreasing concentrations and further detoxifying chemicals.

5) Unlike the 96-hour acute toxicity LC-50 tests in the lab, organisms in the field would only be exposure to herbicides for a brief time.
6) The "safety threshold" used in this analysis is the most conservative threshold recommended.
7) Aerial treatment will not occur within 300 feet of a stream, lake or water body, which supports westslope cutthroat, Yellowstone trout, or other species of special consideration.
8) The analysis is extremely conservative and does not take into account the capability of aquatic organisms to move out of contaminated stream reaches.
9) None of the 17 HUCs showing some risk for exceeding "safe" concentrations in surface waters are proposed for aerial treatment.

Limiting the amount of picloram that can be applied within the 17 HUCs would ensure that instream concentrations remain below the 0.12 ppm and effects on organisms in the water would be discountable. However, ground application of picloram near water bodies will be restricted to 50 feet from the water's edge, or the edge of subirrigated land, whichever distance is greater, or on high run-off areas (Chapter 2-Environmental Protection Measures). Within this buffer zone, only those chemicals with short persistence and classified as slightly toxic or practically non-toxic (LC_{50} >10 mg/l) will be used. Examples include aquatic approved glyphosphate, 2,4-D, and triclopyr. Rodeo® is a preparation of glyphosate specifically formulated for applications directly into water. Some formulations of 2,4-D (Weedar 64®) can be used in close proximity to water and have the advantage of being selective for broadleaf plants. Triclopyr is "practically non-toxic" to fish (USDOE, 2000).

Information is limited on the types of surfactants used and the toxicity of surfactants. Surfactants are proposed for use with the same mitigation measures as picloram. Only those labeled for use in and around water would be used within 50 feet of water, or the edge of subirrigated land, whichever distance is greater, or on high run-off areas. Some surfactants are labeled for use in and around water including: Activate Plus ®, LI-700 ®, Preference ®, R-11 ®, Widespread®, and X-77®.

The non-herbicide treatments proposed under this alternative would have negligible effects on water resources. Mechanical treatments could result in localized soil disturbance but an increase in sediment to streams would likely be undetectable for several reasons. Disturbed areas would be quite localized and would be reseeded with desirable species after treatment, reducing erosion as roots become established. Project related soil disturbance would be minimal and localized. Cultural treatments (seeding, transplanting, and fertilizing) would not affect fisheries or water quality. Fertilizers would be applied according to Forest Service and manufacturer guidelines. Runoff nutrient concentrations would not be large enough to measurably enrich streams, as is the case with current Gallatin National Forest road construction projects. Seeding and transplanting would involve limited soil disturbance. Release of biological control agents would have no direct effect on fisheries or surface water quality. These agents would not compete with aquatic insect species since their food base is very specific, nor would they provide more than an incidental food source for fish.

In summary, direct impacts of herbicides, surfactants and non-herbicide treatments, as mitigated, are expected to be negligible. Therefore, habitat quantity and quality will not be impacted, nor will fish or amphibian populations.

Indirect effects can result from alterations in the composition of vegetative ground cover through proliferation or reduction of noxious weeds. On sloped terrain, the possibility of surface runoff and sediment introduction into streams and other water bodies increases as weeds replace bunchgrasses and other vegetation. If sediment introduction is excessive, fish habitat and amphibian habitat could become degraded (Platts, 1991; Maxell, 2000). Instream cover for fish might also change, based on alterations in riparian vegetation along stream margins. Additional effects to fish could include short-term changes in food supply, should aquatic invertebrates be susceptible to low concentrations of herbicides.

Control of noxious weeds using methods described for this alternative would benefit both fish and amphibian habitat conditions by retaining native vegetation both in riparian and upslope areas. The mitigation measures and herbicide limits described above greatly reduce the likelihood that herbicide application will have any negative impacts.

Direct and Indirect Effects - Alternative 2 (No Herbicide), Water Quality, Fisheries, And Amphibians

The water and fisheries effects of the no herbicide alternative are negligible since treatments on Gallatin National Forest land would be entirely bio-control, cultural, or mechanical.

Direct and Indirect Effects - Alternative 3 (No Change from Current Management), Water Quality, Fisheries, And Amphibians

This alternative would involve only about ten percent of the herbicide use in analyzed in Alternative 1 so risks to water quality and fish are reduced from those described for Alternative 1. This alternative involves less bio-control and no cultural control. Mechanical treatment is much larger (450 acres) than any other alternative so potential for soil erosion and sedimentation is greater than the other alternatives but still quite limited.

Direct and Indirect Effects - Alternative 4 (No Aerial Application), Water Quality, Fisheries, And Amphibians

Alternative 4 is similar to Alternative 1 for bio-control, mechanical, and herbicide treatments. No aerial herbicide treatments would be applied, slightly reducing the risk of accidental herbicide contamination of surface water as compared to Alternative 1. The effects and mitigation measures for ground treatment in Alternative 1 also apply for Alternative 4. Therefore, impacts to fish, amphibians and their habitats are effectively the same for this alternative as for Alternative 1.

Cumulative Effects to Water Quality, Fisheries, And Amphibians

Weed treatments with herbicides will also occur within some of the HUC6 watersheds by county weed control districts treating weeds along roads, adjacent private landowners, and other Forest Service projects. The Forest Service projects are directly regulated by the mitigation measures in this EIS. The Forest Service has no direct jurisdiction over weed control methods by the counties or private landowners but their weed herbicide control activities are required to follow EPA label requirements. Assuming county and private landowner weed control activities follow requirements, no measurable direct/indirect effects should occur on water quality and fisheries. However, if county and private landowners violate EPA label requirements or have herbicide spills in or near steam, lakes, or wetlands then adverse impacts to the aquatic systems could occur.

As proposed, Alternatives 1, 3 and 4 are not expected to cumulatively interact with past, current, and reasonably foreseeable actions to negatively impact sensitive amphibian populations. Alternatives 1, 3 and 4 are also not expected to have negative cumulative impacts on Management Indicator Species or sensitive fish populations. Alternative 2 (No Action) will maintain existing cumulative effects to amphibians, Management Indicator Species, and sensitive fish populations.

Biological Evaluation Determination

Fish Species

Westslope cutthroat trout and fluvial Arctic grayling are Forest Service Northern Region sensitive fish species that historically inhabited the upper Missouri River drainage (Benke, 1992; Vincent, 1962). Thus, the Gallatin River and Madison River drainages are classified as historical habitat for these two species. As noted in Table 3-10, some portions of the project area contain westslope cutthroat trout. There is no documented presence of Arctic grayling within the analysis area. An attempt has been made by Montana Fish Wildlife Projects to reintroduce fluvial Arctic Grayling into the upper Gallatin River over the past several years. The success of this effort is not known. The Yellowstone cutthroat trout is a Forest Service Northern Region sensitive fish species that historically inhabited the upper Yellowstone River drainage (Varley and Gresswell, 1988). Yellowstone cutthroat remain widely distributed in the drainage, but populations are fragmented and, in many cases, reduced to headwater streams.

The proposed action, as mitigated, is expected to pose little risk to fish populations and their habitat. Therefore, this action may impact individual Arctic grayling and westslope cutthroat trout, but will not impact populations of these species.

Amphibian Species

The northern leopard frog and the western toad are on the sensitive amphibian species list for the Northern Region of the Forest Service. The northern leopard frog is widely distributed at lower elevations but is rare on the Gallatin National Forest. Western toads are locally present across the project area.

Northern leopard frogs breed from mid-March to early June (Maxell, 2000). Mating occurs when males congregate in shallow water and begin calling during the day (Maxell, 2000). Eggs are laid at the water surface in large, globular masses of 150 to 500 (Maxell, 2000). Young and adult frogs often disperse into marsh and forest habitats, but are not usually found far from open water (Maxell 2000).

Western toads inhabit all types of aquatic habitats ranging from sea level to 12,000 in elevation (Maxell, 2000). They breed in lakes, ponds, and slow streams, preferring shallow areas with mud bottoms (Maxell, 2000). Western toads breed from May to July, laying long, clear double-strings of eggs (Maxell, 2000). Tadpoles metamorphose in 40 to 70 days (Maxell, 2000). Because of their narrow environmental tolerance (10-25 C throughout the year), adults must utilize thermally buffered microhabitats during the day, and can be found under logs or in rodent burrows (Maxell, 2000). Adults are active at night and can be found foraging for insects in warm, low-lying areas (Maxell, 2000).

The proposed action, as mitigated, is expected to pose little risk to amphibian populations and their habitat. Therefore, this action may impact individual boreal toads or northern leopard frogs, but will not impact populations of these species.

Table 4 –11. Biological Evaluation Determination for Sensitive Species.

Species	Determination	Comments
Westslope cutthroat	MIIH	Based on the slight risk of a spill.
Yellowstone cutthroat	MIIH	Based on the slight risk of a spill.
Arctic grayling	MIIH	Based on the slight risk of a spill.
Northern leopard frog	MIIH	Based on the slight risk of a spill.
Western toad	MIIH	Based on the slight risk of a spill.

MIIH – May Impact Individuals, but will not lead toward listing or loss of viability to the species.

Monitoring Requirements

Monitoring for aerial application will consist of detection cards as described in Chapter 2 (Environmental Protection Measures).

A field inspector will be present during all aerial application to monitor drift using 12” x 12” Spray detection cards placed in buffer areas along any stream or lake comprising a sport fishery, or waters important for Threatened, Endangered or Sensitive (TES) aquatic species. Cards will be placed prior to herbicide application and will be sufficient in number and distribution to adequately determine when drift of herbicide into the buffer area exceeds acceptable levels.

Consistency with Forest Plan and other Laws, Regulations and Policies to Water Quality, Fisheries, And Amphibians

All alternatives would meet all water quality standards and maintain beneficial uses of surface water and groundwater resources, assuming implementation of environmental protection measures and other mitigation measures occurs as necessary.

WILDLIFE -

Direct and Indirect Effects to Wildlife

There is a concern that weed treatments may impact wildlife by herbicide toxicity, by habitat modification, and by displacement during treatment. For analysis purpose the wildlife species will be divided into four groups for each alternative: Threatened and Endangered Species; Sensitive Species; Management Indicator Species; and Migratory Bird Species. Mitigation measures will be outlined prior to the effects analysis of each alternative.

Mitigation Common to all Alternatives

No human activities associated with weed control would be allowed within zone I (within 400 meters) of an active bald eagle nest from February 1-August 15, except within 20 feet of roads that are open for public motorized use.

Herbicides would only be applied at concentrations that would avoid tree mortality to protect potential nesting habitat for bald eagles and other species.

Sheep and Goat Grazing: A herder and guard dogs would be present to monitor sheep and goats used for weed control purposes at all times. The herder would be required to notify the local District Ranger and remove the live stock within 24 hours of any loss of sheep or goats being used for weed control purposes on the Gallatin National Forest. The herder would be required to comply with the Gallatin National Forest food storage order so that human and livestock/pet foods, refuse, and other attractants were made unavailable to bears. The carcasses of sheep or goats that died while being used for weed control would be removed from the Gallatin National Forest within 24 hours to avoid habituation of grizzly bears or wolves to livestock as carrion. Sheep and goats used for weed control would be contained each night within the perimeter of an electric fence. Herders of sheep and goats used for weed control purposed would be required to receive training from the U.S. Fish & Wildlife Service or other authorized organization in the use of hazing techniques to prevent depredations by wolves. Herders would be required to implement those techniques when wolves are known to be in proximity to domestic sheep or goats being used for weed control.

To prevent disease transmission between domestic sheep or goats and bighorn sheep, all proposals for goat or sheep grazing for weed control purposes would be coordinated with the appropriate Montana Fish, Wildlife and Parks biologist to determine if bighorn sheep may occur in the area. At least nine miles of separation would be maintained between bighorn sheep and domestic sheep or goats being used for weed control purposes.

District/Forest wildlife biologists would review and coordinate weed management projects with the District/Forest weed coordinators to identify raptor nesting areas, grizzly bear core habitat, wolf territories, or other critical wildlife areas that may be affected by weed control activities, to ensure the mitigation measures described in this report are implemented properly.

Additional Mitigation for Alternative 1

No aerial herbicide spraying would be allowed within zones I or II (within 800 meters) of an active bald eagle nest from February 1-August 15.

No aerial spraying within 1 mile of an active peregrine falcon nest from April 1-August 15.

No aerial application would be allowed within 400 meters of an active goshawk nest from April 1-August 15.

Only eight hours of aerial spraying would be allowed in grizzly bear core habitat within a given Bear Management Subunit each year.

Direct and Indirect Effects – Grizzly Bear

Grizzly Bear - Herbicide Toxicity, Alternative 1 (Proposed Action), Direct and Indirect Effects

This alternative proposes more acres of herbicide treatment than all other alternatives. Grizzly bears would be likely to occasionally contact herbicides by ingesting plants that had been sprayed and by dermal absorption following contact with sprayed plants. There is also a very small chance that grizzly bears could be directly sprayed with herbicide during aerial application. However, the toxicity of herbicides proposed for use is low, as are the chances of grizzly bears receiving doses great enough to cause toxic effects. However, this must be qualified by the fact that there is uncertainty regarding the toxicity of some herbicides and inert ingredients.

Grizzly Bear - Habitat Modification, Alternative 1 (Proposed Action), Direct and Indirect Effects

Compared to the No Change from Current Action - Alternative 3, more vegetation would be treated with herbicides. Therefore, there would be a larger short-term loss of forage resulting from mortality of non-target plants in treatment areas. However, native vegetation would begin to recover and provide forage within two to three years of herbicide treatment (Rice et al. 1997, page 631). Long-term impacts to grizzly bear spring foraging opportunities as weeds out-compete native vegetation would be lower than under the Alternative 3 (No Change from Current Action), because the acreage of untreated weed infestations would be smaller.

Grazing by goats and sheep in grizzly bear habitat to favor the growth of native plants would be used under this alternative. Grizzly bears could be attracted to and prey upon these animals. This could result in the conditioning of grizzly bears to livestock as food, and lead to conflicts with livestock on adjacent grazing allotments resulting in management removals of grizzly bears. However, goats and sheep would be used in localized areas. Bands of sheep and goats would be much smaller than those typically associated with commercial livestock grazing. Additionally, mitigation measures would be applied to lessen the chances of depredation conflicts developing. Herders and guard dogs would be used to monitor herds, and would immediately report any depredations. Electric fencing would be used to contain sheep and goats at night. Camps would be subject to the food storage order and herders required to dispose of any sheep or goat carcasses to prevent attracting bears. Sheep and goats would be removed from the Forest if grizzly bear depredations were to occur. Application of the above mitigation measures would ensure compliance with applicable Gallatin Forest Plan grizzly bear standards (USDA Forest Service, pages G-15, G-16). Use of goats and sheep for weed control under this alternative would also be in compliance with standards from the Final Conservation Strategy for Grizzly Bears in the Yellowstone Area (IGBC 2003, page 43) because grazing would be temporary and occur outside of any existing allotment, no new allotment would be created, and no animal months would be allocated.

Grizzly Bear - Disturbance And Displacement, Alternative 1 (Proposed Action), Direct and Indirect Effects

The potential for disturbance or displacement of grizzly bears would be similar to that under Alternative 4 (No Aerial Application), except that there would be an additional chance of displacing bears with aerial spraying. No aerial spraying is currently proposed within grizzly bear core habitat, although the need for this activity may arise in the future. Aerial spraying of a weed patch would occur once per year, and would be completed in several hours or less. Mitigation measures would be applied to allow only 8 hours of aerial spraying within core habitat per Bear Management Sub-unit per year in order to limit disturbance within this important habitat. This would be consistent with core habitat management direction from Forest Plan Amendment 19 and the Conservation Strategy, because there would be no reduction in core habitat and there would be no reoccurring low-level helicopter flights over core habitat.

Grizzly Bear - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 2 (No Herbicides), Direct and Indirect Effects

There would be no toxic effects to grizzly bears under this alternative because no herbicides would be used.

Under this alternative there would be no short-term loss of grizzly bear forage resulting from non-target plants killed by herbicides, because no herbicides would be used. Instead, the long-term availability of native forage plants would be reduced as they are out-competed by weeds.

The effects of sheep and goat grazing for weed management on grizzly bears would be similar under all alternatives. Their effects are described in detail under Alternative 1.

Disturbance and displacement of grizzly bears under this alternative would be minimal. Mechanical and herbicide treatments require the most human activity and have the most potential to cause disturbance. No herbicide treatment and very limited amounts of mechanical treatment would be used under this alternative.

Grizzly Bear - Herbicide toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 3 (No Change from Current Management), Direct and Indirect Effects

Grizzly bears would be likely to occasionally contact herbicides by ingesting plants that had been sprayed and by dermal absorption following contact with sprayed plants. The toxicity of herbicides proposed for use is low, along with the chances of grizzly bears receiving doses great enough to cause toxic effects. However, this must be qualified by the fact that there is uncertainty regarding the toxicity of some herbicides and inert ingredients.

Under this alternative, grizzly bear habitat would be treated with herbicides each year. These areas would have reduced foraging capacity for grizzly bears because non-target plants would be killed by broad-spectrum herbicides until native vegetation began recovering within 2-3 years of herbicide treatment (Rice et al. 1997, page 631). Weed infestations are most likely to occur in association with roads or other human developments, while grizzly bears tend to avoid those same disturbances (IGBC 1998). Despite this potential spatial separation, it is highly likely that grizzly bears use areas with weed infestations to some degree. However, many weed infestations would not be treated, and they would continue to spread and displace native forage plants (especially in lower-elevation sagebrush/grassland habitat types). Grizzly bears forage in these areas primarily during spring or early summer when green plants are emerging but higher-elevation habitats are still snow-covered (Servheen 1993, page 7). The long-term availability of spring forage for grizzly bears would be somewhat reduced by the continued spread of weeds. Other important grizzly bear habitats including avalanche chutes, high elevation meadows, and whitebark pine stands that would be largely unaffected since they are at low risk for weed infestations. The effects of sheep and goat grazing for weed management on grizzly bears would be similar under all alternatives. Their effects are described in detail under Alternative 1.

It is likely that grizzly bears would occasionally be displaced as a result of weed treatment activities. However, activities such as herbicide spraying and grubbing would be of short duration in any given spot, so any displacement would be localized and last only a few days. Bears could resume use of treated areas shortly thereafter.

Grizzly Bear -Herbicide Toxicity, Habitat Modification, Disturbance and Displacement, Alternative 4 (No Aerial Application), Direct and Indirect Effects

The chances of grizzly bears contacting herbicides would be slightly smaller than under Alternative 1 (the proposed action), due to the lack of aerial spraying. Otherwise, the effects of this alternative would be similar to those described under Alternative 1.

The impacts would be very similar to those described under Alternative 1, except for a small long-term reduction in potential spring foraging areas due to the lack of aerial spraying. The effects of sheep and goat grazing for weed management on grizzly bears would be similar under all alternatives. Their effects are described in detail under Alternative 1.

The chances of disturbance and displacement of grizzly bears would be very similar to those described under Alternative 1 (the proposed action). The main difference is that there would be no aerial spraying, so disturbance and displacement of bears would be somewhat less likely to occur than in Alternative 1.

Cumulative Effects – Grizzly Bear

Grizzly Bear – Alternative 1 – Cumulative Effects

Cumulative effects to grizzly bears resulting from herbicide use in this alternative would be similar to those described under Alternative 3 (No Action), because the herbicides proposed for use are rapidly excreted and do not bio-accumulate. Weed control activities would not alter access values and impacts to grizzly bear core habitat from aerial spraying would be mitigated, therefore any disturbance to grizzly bears resulting from this alternative would not contribute to cumulative effects on grizzly bears. This alternative would have a greater probability of containing the spread of weeds than the others and would have the least cumulative effects on grizzly bear foraging opportunities.

Grizzly bear – Alternative 2 – Cumulative Effects

No herbicides would be used, so there would be no cumulative toxic effects. Weed control activities would not impact core areas or alter other access values, so any disturbance to grizzly bears resulting from this alternative would have discountable cumulative effects. This alternative would have a lower probability of containing the spread of weeds than all others and would do the least to preserve grizzly bear foraging opportunities. It would therefore have more cumulative effects than other alternatives.

Grizzly bear – Alternative 3 – Cumulative Effects

Cumulative effects to grizzly bears were analyzed for the 16 Bear Management Subunits on the Gallatin National Forest (Boulder Slough #1&2; Crandall/Sunlight #1 &2; Hellroaring/Bear #1&2; Gallatin #1,2, &3; Hilgard #1&2; Lamar #1; Madison #1&2; Henry's Lake #2; and Plateau #1), because Bear Management Subunits are approximately the average size of a female grizzly bear's home range and contain all necessary seasonal habitat components. The temporal bounds for the analysis were the past 10 years and 15 years into the future, because weed infestations have changed rapidly and it is difficult to predict how their spread beyond that timeframe would affect grizzly bear habitat.

Weed control with herbicides is an activity that has been occurring for years in the analysis area, and undoubtedly will continue for many years into the future. Private landowners, county governments, and other state and federal agencies all use herbicides to control weeds. However, this use has been compatible with grizzly bear recovery and is expected to continue to be so. The herbicides proposed for use are water-soluble and do not bio-magnify, so cumulative toxic effects to grizzly bears resulting from these processes would not occur.

A large variety of human activities occur in the analysis area, many of which may disturb or displace grizzly bears. Grizzly bear access management in the recovery zone is designed to balance these effects by providing core habitat characterized by a low level of human activity that could cause disturbance to bears. The analysis area was 3,319 mi^2, and approximately 2,648 mi^2 or 80% of this was secure habitat (IGBC 2003, page 151). The amount of secure habitat in these Bear Management Subunits was deemed adequate, because at least that much was present in 1998 when the grizzly bear population achieved recovery goals (IGBS 2003, page 145). The exceptions were the Henry's Lake #2, Gallatin #3, and Madison #2 Bear Management Subunits that were identified as having potential for improvement (IGBC 2003, pages 43-44). Aerial spraying in core habitat could temporarily displace grizzly bears from localized areas. However, cumulative effects resulting from such actions would be discountable, due to their short duration and localized nature. Adjacent areas of core habitat would continue to be managed to provide secure grizzly bear habitat.

Threats to several major grizzly bear food sources in the analysis area have been documented. The long-term persistence of whitebark pine trees, whose nuts provide a critical seasonal food source for grizzly bears (Mattson et al. 1990, page 1622), is threatened by blister rust, mountain pine beetle attack, and climate change (Tomback et al. 2001, page 9). Increased development of private lands may decrease habitat availability for ungulate populations, which are more important to bears in the Yellowstone area than to other grizzly populations (IGBC 2003, page 46).

Bears may be forced to rely more on herbaceous vegetation if these food sources decline in the future. Weeds have not been implicated as a major threat to grizzly bear forage, but the potential does exist for this to become more of an issue in the future if weeds spread into core habitat and other areas with low access densities that are preferred grizzly bear habitat. Although there is uncertainty regarding the ultimate impacts of weeds on grizzly bear foraging opportunities in the analysis area over the long-term, it is likely that over the next 15 years weeds would not have a major impact due to the broad diets of bears and the current low amount of weed infestation in the most important bear habitats. Forest Service projects such as timber sales and prescribed fires, road maintenance, recreational activities and vehicle use, special use permits (both recreation events and non-recreation), livestock grazing, and summer home residence may contribute to the spread of weeds. Recently adopted Best Management Practices (Forest Service Manual 2080) for preventing weed spread are incorporated as mitigation measures in project plans, which would help limit weed spread from Forest Service actions. Therefore, even though this alternative would be insufficient to contain the spread of most weed infestations, cumulative impacts to grizzly bear foraging opportunities would be low.

Grizzly bear - Alternative 4 - Cumulative Effects

Cumulative effects to grizzly bears resulting from herbicide use in this alternative would be similar to those described under Alternative 3 (No Action), because the herbicides proposed for use are rapidly excreted and do not bio-accumulate. Weed control activities would not impact core areas or alter other access values, so any disturbance to grizzly bears resulting from this alternative would have discountable cumulative effects. This alternative would be more likely to contain the spread of weeds than the No Action Alternative, and would have lower cumulative effects on grizzly bears.

Direct and Indirect Effects – Gray Wolf

Gray Wolf - Herbicide Toxicity, Alternative 1 (Proposed Action), Direct and Indirect Effects

Wolves would be likely to occasionally contact herbicides by dermal absorption following contact with sprayed plants. There is also a very small chance that they could be directly sprayed with herbicide during aerial application. However, the toxicity of herbicides proposed for use is low (Table 3-14). Although there is uncertainty involved with the toxicity of some herbicides and inert ingredients, the chances of wolves receiving doses great enough to cause toxic effects are very low.

Gray Wolf - Habitat Modification, Alternative 1 (Proposed Action), Direct and Indirect Effects

Under this alternative, fewer acres of weed infestations would go untreated compared to all other alternatives. Elk populations, which are the primary prey for wolves, are not currently limited by weed infestations so short-term effects on wolves would be similar to the Alternative 3 (No Change from Current Action). The long term effects of weed infestations on elk populations are uncertain, but this alternative would do the most to maintain forage for the prey populations that wolves are dependent on.

As with grizzly bears, the use of sheep and goats for weed management could lead to possible conflicts with wolves. Wolf depredation can be a problem when commercial sheep grazing operations are located in proximity to areas occupied by wolves (USFWS 1987, page 71). This could lead to conditioning of wolves to livestock as food, and lead to conflicts with livestock on adjacent grazing allotments resulting in management removals of grizzly bears. However, the grazing use proposed in this alternative differs from typical commercial grazing operations in several key ways that would reduce the likelihood of this occurring.

Goats and sheep would be used in localized areas. Bands of sheep and goats would be much smaller than those typically associated with commercial livestock grazing. Additionally, mitigation measures would be applied to lessen the chances of depredation conflicts developing. Herders and guard dogs would be used to monitor herds, and would immediately report any losses of their stock. Herders would be required to immediately dispose of any sheep or goat carcasses to prevent attracting wolves, receive training from the U.S. Fish and Wildlife Service or other authorized organization in the use of hazing techniques to prevent depredations by wolves, and to implement those techniques when wolves are known to be in proximity to domestic sheep or goats being used for weed control. Electric fencing would be used to contain sheep and goats at night. Sheep and goats would be removed from the Forest if wolf depredations were to occur. Despite such precautions, wolves have preyed upon domestic sheep being used for weed control in the Yellowstone area (Bangs 2003, page 2) with resulting management removal of a wolf, and there is potential for this to occur on the Forest when goats or sheep are used.

Gray Wolf - Disturbance And Displacement, Alternative 1 (Proposed Action), Direct and Indirect Effects

Wolves could be displaced by activities such as ground-based herbicide spraying. However, activities would be of relatively short duration during daylight hours, so disturbance or displacement would be very temporary and affect only localized areas. Aerial spraying would be more likely to disturb or displace wolves than ground spraying, but the additive disturbance of this treatment on wolves would be discountable due to the short duration and localized nature of aerial spraying. Weed treatment activities would not disturb wolf denning activities because dens are typically located in inaccessible areas where weed control would be unlikely to occur (J. Fontaine, U.S. Fish & Wildlife Service, personnel communication on 04/28/03).

Gray Wolf - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 2 (No Herbicides), Direct and Indirect Effects

There would be no toxic effects to gray wolves under this alternative because no herbicides would be used.

The effects of sheep and goat grazing for weed management on wolves would be similar under all alternatives. Their effects are described in detail under Alternative 1.

Long-term negative impacts to elk forage and ultimately the prey base for wolves would be uncertain, but potentially greater for this alternative than all others because the treatments proposed would be the least likely to contain the spread of weeds.

Although weed management activities would vary among alternatives, they would have similar displacement and disturbance effects on wolves. These effects are described in detail in Alternative 1, and are expected to be discountable due to their short duration and localized nature.

Gray Wolf - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 3 (No Change from Current Management), Direct and Indirect Effects

Wolves would occasionally come into contact with herbicides through dermal absorption following contact with treated vegetation. Due to the low toxicity of herbicides proposed for use and the low doses expected with dermal absorption, toxic effects to wolves would be extremely unlikely even with the uncertainty involved regarding the toxicity of some herbicides and inert ingredients.

The acreage of weed treatment would be insufficient to contain the spread of weeds. Elk winter ranges are generally in low-to-mid elevation rangelands that have a high risk for infestation by weeds. Degradation of elk winter ranges on the Forest due to weed infestation would likely lead to lower populations of prey for wolves. The effects of sheep and goat grazing for weed management on wolves would be similar under all alternatives. Their effects are described in detail under Alternative 1.

Although weed management activities would vary among alternatives, they would have similar displacement and disturbance effects on wolves. These effects are described in detail in Alternative 1, and are expected to be discountable due to their short duration and localized nature.

Gray Wolf - Herbicide Toxicity, Habitat Modification, Disturbance and Displacement, Alternative 4 (No Aerial Application), Direct and Indirect Effects

The chances of wolves contacting herbicides would be slightly smaller than under Alternative 1, due to the lack of aerial spraying. Otherwise, the effects of this alternative would be similar to those described under Alternative 1.

The treatment proposed under this alternative would lead to long-term improved elk winter range conditions when compared to the Alternative 3 (No Action), but potentially less favorable than those expected under Alternative 1 (the proposed action). In the foreseeable future, the treatments proposed under this alternative would be likely to maintain prey populations at levels sufficient to support wolves. The effects of sheep and goat grazing for weed management on wolves would be similar under all alternatives. Their effects are described in detail under Alternative 1.

Although weed management activities would vary among alternatives, they would have similar displacement and disturbance effects on wolves. These effects are described in detail in Alternative 1, and are expected to be discountable due to their short duration and localized nature.

Cumulative Effects – Gray Wolf

Gray Wolf – Alternative 1 – Cumulative Effects

Cumulative effects to wolves resulting from herbicide use in this alternative would be similar to those described under Alternative 3 (No Action), because of the low potential for herbicides proposed for use to bio-magnify. Weed control activities would not impact dens, and any disturbance to wolves resulting from this alternative would have discountable cumulative effects. This alternative would have the greatest probability of containing the spread of weeds, and would do the most to preserve elk populations that provide the forage base for wolves. It would have the least cumulative effects on wolves.

Gray Wolf – Alternative 2 – Cumulative Effects

No herbicides would be used, so there would be no cumulative toxic effects. The potential for disturbance and displacement would be lowest under this alternative, and would have discountable cumulative effects. This alternative would be more likely to contribute to cumulative effects on wolves than Alternative 3 (No Action), because it would be less likely to contain the spread of weeds in elk habitat over the next 15 years and lower elk populations could result.

Gray Wolf – Alternative 3 – Cumulative Effects

Cumulative effects to gray wolves were analyzed for the Madison, Gallatin, Bridger, Emigrant, Absaroka, and Crazy Elk Management Units (EMU's), which contain all seasonal ranges for elk on the Gallatin National Forest. EMU's were delineated in the Statewide Elk Management Plan for Montana as a collection of hunting districts that share similar ecological conditions and encompass the yearlong range of major elk populations (Youmans 1992, page 3). They were used because elk populations are the primary factor determining wolf distribution on the Forest. The temporal bounds for the analysis were the past 10 years and 15 years into the future. Because weed infestations have changed rapidly and it is difficult to predict how they will spread beyond that timeframe, it will also be difficult to predict how weeds would affect wolves and their prey.

Weed control with herbicides is an activity that has been occurring for years in the analysis area, and undoubtedly will continue for many years into the future. Private landowners, county governments, and other state and federal agencies all use herbicides to control weeds. However, this use has been compatible with wolf recovery and is expected to continue to be so in the future. The herbicides proposed for use are water-soluble and do not bio-magnify, so cumulative toxic effects to wolves under this alternative would not occur.

A large variety of human activities occur in the analysis area. Isolated cases of disturbance to wolf dens from human activity have occurred in the past (Smith 1998, page 5), but have not affected wolf recovery. Disturbance or displacement of wolves under this alternative would be infrequent and have discountable cumulative effects to wolves.

Elk populations, which provide the bulk of the forage base for wolves in the analysis area, are generally robust. Private land development is probably the main threat to elk populations, but public land winter range is also available. The quality of public lands winter ranges may become more important in the future, as private lands winter ranges are lost to development. The continued spread of weeds on elk winter ranges could decrease forage availability and ultimately elk populations within the next 15 years. This alternative could contribute to cumulative effects on wolves because it may not be sufficient to contain the spread of weeds in important elk habitat, and lower elk populations could result.

Other Forest Service projects such as timber sales and prescribed fires, road maintenance, recreational activities and vehicle use, special use permits (both recreation events and non-recreation), livestock grazing, and summer home residence may contribute to the spread of weeds in winter range areas. Recently adopted Best Management Practices (Forest Service Manual 2080) for preventing weed spread are incorporated as mitigation measures in project plans, which would help limit weed spread from Forest Service actions.

Gray Wolf - Alternative 4 - Cumulative Effects

The herbicides proposed for use are water-soluble and do not bio-accumulate, so cumulative toxic effects to wolves resulting from bio-accumulation would not occur. The potential for disturbance and displacement of wolves would be greater than under Alternative 3 (No Action), but would still have discountable cumulative effects. This alternative would contribute less to cumulative impacts on wolves than Alternative 3 (No Action) because treatments would be more likely to contain the spread of weeds in elk habitat and higher elk populations could result.

<u>Direct and Indirect Effects – Bald Eagle</u>

Bald Eagle - Herbicide Toxicity, Alternative 1 (Proposed Action), Direct and Indirect Effects

Bald eagles would be most likely to contact herbicides around Hebgen Lake. This is especially true for Horse Butte, where there are numerous weed infestations and three nesting pairs of bald eagles. Eagles may occasionally perch on the ground in treated areas, and could absorb small amounts of herbicide through contact with sprayed vegetation. No aerial spraying would be allowed within 800 meters of an active bald eagle nest, which would prevent the direct spraying of adult birds or chicks on their nests. The chances of bald eagles being directly sprayed would otherwise be very remote. The amount of herbicide absorbed would be very low, and toxic effects would be unlikely due to the low toxicity of herbicides proposed for use. However, this must be qualified by the fact that there is uncertainty regarding the toxicity of some herbicides and inert ingredients. The herbicides proposed for use do not appear to bio-accumulate or bio-magnify, so the probability of toxic effects to eagles resulting from them eating contaminated prey would also be very low.

Bald Eagle - Habitat Modification, Alternative 1 (Proposed Action), Direct and Indirect Effects

Weed infestations and treatments proposed under this alternative would have little affect upon bald eagle habitat. Weeds have not affected aquatic systems supporting fish populations on Hebgen and Earthquake Lakes that in turn provide the majority of forage for breeding bald eagles on the Forest. Fish populations in major water bodies such as Hebgen and Earthquake Lakes that are the most important to bald eagles would not be affected by herbicide use because mitigation measures would be applied to protect aquatic species (see Fisheries/Amphibians specialist's report) and the large volume of water in these lakes would dilute any herbicides that entered the system to non-toxic levels.

Bald Eagle - Disturbance And Displacement, Alternative 1 (Proposed Action), Direct and Indirect Effects

Because of the high potential for disturbance to nesting eagles from aerial spraying, mitigation measures would be applied preventing aerial spraying within zones I or II (less than 800 meters) of bald eagle nests. Ground-based human activities associated with the project would not be allowed within zone I (less than 400 meters) of an active nest, except along roadways open to public motorized use (such as the Horse Butte Road #610) where disturbance already occurs. These measures would be in compliance with recommendations for bald eagle nesting territory management (Greater Yellowstone Bald Eagle Working Group 1996, pages 24-25) and would effectively prevent disturbance of nesting eagles. Project activities could otherwise lead to the occasional disturbance and displacement of foraging eagles, but these effects would normally be discountable due to the localized nature of treatments and the availability of alternative foraging locations.

Bald Eagle - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 2 (No Herbicides), Direct and Indirect Effects

There would be no toxic effects to bald eagles under this alternative because no herbicides would be used.

Impacts to bald eagle habitat would be very similar under all alternatives. The effects are described in detail under Alternative 1. The only difference is that elk populations could be lower under this alternative, possibly leading to reduced availability of carrion for eagles.

The potential for disturbance or displacement of foraging bald eagles would be very low because biocontrol would be the treatment method affecting the most acres. Little human activity is associated with biocontrol. Mechanical and herbicide treatments require the most human activity and have the most potential to cause disturbance. No herbicide treatment and very limited amounts of mechanical treatment would be used under this alternative.

Bald Eagle - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 3(No Change from Current Management), Direct and Indirect Effects

The effects of this alternative would similar to those described in Alternative 1, except that there would be a lower chance of bald eagles contacting herbicides due to the lower number of acres proposed for treatment.

Impacts to bald eagle habitat would be very similar under all alternatives. The effects are described in detail under Alternative 1. The difference is that elk populations could be lower under this alternative, possibly leading to reduced availability of carrion for eagles.

The potential for disturbance and displacement of bald eagles would be lower than under Alternative 1, because no aerial spraying would occur and fewer acres would be treated using ground-based activities. Bald eagles could be still disturbed or displaced by weed control activities, especially by ground-based herbicide spraying around nests in the Horse Butte area. The same mitigation measures would apply to ground-based weed management activities to prevent disturbance of nesting eagles.

Bald Eagle – Herbicide Toxicity, Habitat Modification, Disturbance and Displacement – Alternative 4 (No Aerial Application), Direct and Indirect Effects

The effects of this alternative would be similar to those described in Alternative 1, except that there would be a slightly lower chance of bald eagles contacting herbicides due to the lower number of acres proposed for treatment.

The effects of this alternative would be similar to those described in Alternative 1, except that there would be a slightly lower chance of bald eagles contacting herbicides due to the lower number of acres proposed for treatment.

The potential for disturbance and displacement of bald eagles would be lower than under Alternative 1, because no aerial spraying would occur. Bald eagles could be still disturbed or displaced by weed control activities, especially by ground-based herbicide spraying around nests in the Horse Butte area. The same mitigation measures would apply to ground-based weed management activities to prevent disturbance of nesting eagles.

<u>Cumulative Effects – Bald Eagle</u>

Bald Eagle – Alternative 1 – Cumulative Effects

Cumulative effects to eagles resulting from herbicide use in this alternative would be similar to those described under Alternative 3 (No Action), because the herbicides proposed for use are rapidly excreted and do not bio-accumulate. Cumulative impacts of disturbance to foraging eagles resulting from this alternative would be slightly greater than under the No Action Alternative. However, these effects would be very slight due to the short duration and localized nature of the proposed treatments. As for the No Action Alternative, there would be no cumulative effects to bald eagle forage or their habitat.

Bald Eagle – Alternative 2 – Cumulative Effects

No herbicides would be used, so there would be no cumulative toxic effects. The potential for disturbance and displacement of eagles would be minimal under this alternative, and would have discountable cumulative effects because alternate foraging areas would still be available. This alternative would have no direct or indirect effect upon the forage base for eagles or their habitat, and would not have any cumulative effect.

Bald Eagle – Alternative 3 – Cumulative Effects

The analysis area for bald eagles was the area inhabited by the Greater Yellowstone bald eagle population as described in the Greater Yellowstone Bald Eagle Management Plan (Greater Yellowstone Bald Eagle Working Group 1996, page 2). The temporal bounds for the analysis were the past 10 years and 15 years into the future, because weed infestations have changed rapidly and it is difficult to predict how their spread beyond that timeframe would affect eagles.

Weed control with herbicides is an activity that has been occurring for years in the analysis area, and undoubtedly will continue for many years into the future. Private landowners, county governments, and other state and federal agencies all use herbicides to control weeds. Other pesticides including organophosphates and carbamates are also in use and have caused bald eagle mortalities in the analysis area (Greater Yellowstone Bald Eagle Working Group 1996, page 15).

However, the herbicides proposed for use are water-soluble and do not bio-magnify. Therefore, no toxic cumulative effects to bald eagles are expected under this alternative.

A large variety of human activities occur in the analysis area. The human population in the analysis area is growing rapidly. The potential for disturbance and displacement of eagles has therefore also increased. Although private land eagle habitat may be affected more, recreational use of public lands will also continue to cause disturbance problems for eagles in the future. Disturbance to nesting bald eagles would largely be mitigated under this alternative. There would be some cumulative effects to foraging bald eagles that were displaced due to weed control activities under this alternative, because birds would be displaced to other areas that would likely have human activities such as fishing and boating. They could also be discouraged from foraging in these areas. Recreational activities are currently not high enough to prevent bald eagles from finding adequate forage, but could increase to that level within the next 15 years. However, the disturbance and displacement of foraging eagles resulting from this alternative would be discountable because of effective mitigation measures, and the localized, short duration nature of activities.

This alternative would have no direct or indirect effect upon the forage base for eagles or their habitat, and would therefore not have any cumulative effect.

Bald Eagle - Alternative 4 - Cumulative Effects

The herbicides proposed for use are water-soluble and do not bio-accumulate, so cumulative toxic effects to bald eagles resulting from bio-accumulation would not occur. The potential for disturbance and displacement would be greater compared to Alternative 3 (No Action), but would have very slight cumulative effects due to the localized nature and short duration of proposed activities. This alternative would have no direct or indirect effect upon the forage base for eagles or their habitat, and would not have any cumulative effect.

<u>Direct and Indirect Effects – Sensitive Species</u>

Sensitive Species - Herbicide Toxicity, Alternative 1 (Proposed Action), Direct and Indirect Effects

The probability would be greater for this alternative than for all other alternatives that sensitive species including the peregrine falcon, northern goshawk, western big-eared bat, and flammulated owl would contact herbicides. The only expected overlap between wolverine habitat and treatment areas would be on big-game winter ranges. However, wolverines would not be expected to contact herbicides because they use big game winter ranges while carrion is available during the winter and early spring, before herbicides would be used. Toxic effects to sensitive species due to the use of herbicides under this alternative are unlikely. Species such as the peregrine falcon, northern goshawk, western big-eared bat, and flammulated owl could occasionally ingest prey that had been sprayed with herbicides because they forage in areas that may receive treatment with herbicide. The herbicides proposed for use have not been found to bio-accumulate or bio-magnify. The toxicity of herbicides proposed for use is low (Table 3-14), as is the chance of these species receiving doses great enough to cause toxic effects. However, this must be qualified by the fact that there is uncertainty regarding the toxicity of some herbicides and inert ingredients.

Sensitive Species - Habitat Modification, Alternative 1 (Proposed Action), Direct and Indirect Effects

The short-term impacts of herbicides on vegetation could cause localized decreases in the abundance of insects, birds, and small mammals that are prey for peregrine falcons, goshawks, western big-eared bats, and flammulated owls. These impacts would be more widespread than those under Alternative 3 (No Change from Current Action), due to the much larger area proposed for treatment. However, populations of these prey species depend on native vegetation and would begin recovering in treated areas within 2-3 years of herbicide treatment (Rice *et al*., 1997, page 631). This alternative would result in more acres of weed infestation successfully treated compared to the Alternative 3, and the long-term availability of forage for these species would be improved.

Sensitive Species – Disturbance And Displacement, Alternative 1 (Proposed Action), Direct and Indirect Effects

The probability of disturbance and displacement of sensitive species under this alternative would be slightly larger than for all other alternatives, due to the use of aerial spraying. The effects would be temporary and localized due to the short duration of aerial spraying. Breeding activities of sensitive species would not be affected because weed control would generally not occur in close proximity to expected nesting areas for species that are sensitive to disturbance such as peregrine falcons and goshawk. No aerial spraying within one mile of known peregrine nests is proposed, although it could be in the future. With mitigation measures that prohibit aerial spraying less than one mile of an active peregrine falcon nest from April 1-August 15 (a good approximation of their nesting dates in southwest Montana) incorporated, this alternative would be consistent with management recommendations for this species because other weed management activities would be within the scope of activities that historically occurred.

Sensitive Species - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 2 (No Herbicides), Direct and Indirect Effects

There would be no toxic effects to sensitive species under this alternative because no herbicides would be used.

The short-term impacts of weed treatment on forage availability for peregrine falcons, goshawks, western big-eared bats, and flammulated owls would be less than under all other alternatives because biocontrol using species-specific agents rather than broad-spectrum herbicides that kill a variety of plants would be the most widespread treatment method. Long-term negative effects of this alternative to sensitive species habitat would be greater than those expected under the Alternative 3 (No Action), because weed treatments would be less likely to contain the spread of weeds.

The potential for disturbance or displacement of sensitive species would be very low because biological control would be the treatment method affecting the most acres. Little human activity is associated with biological control.

Sensitive Species, Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 3 (No Change from Current Management), Direct and Indirect Effects

The effects of this alternative would similar to those described in Alternative 1, except that there would be a lower chance of sensitive species contacting herbicides due to the lower number of acres proposed for treatment and the lack of aerial spraying.

The short-term effects of this alternative upon sensitive species habitat would be similar to those described under Alternative 1, except they would be less widespread due to the much smaller area proposed for treatment. Over the long term, forage availability for these species would decline because the amount of acreage treated would be insufficient to limit the spread of weed infestations.

The probability of disturbance and displacement of sensitive species under this alternative would be smaller than under Alternative 1, due to the lower number of acres proposed for treatment and the lack of aerial spraying. Some disturbance and displacement of sensitive species could still result from weed treatments, but the effects would be temporary and localized. As described in Alternative 1, mitigation measures would be applied to prevent disturbance to breeding goshawks.

Sensitive Species - Herbicide Toxicity, Habitat Modification, Disturbance and Displacement – Alternative 4 (No Aerial Application), Direct and Indirect Effects Herbicide toxicity

The effects of this alternative would similar to those described in Alternative 1, except that there would be a lower chance of sensitive species contacting herbicides due to the lack of aerial spraying.

The negative short-term and positive long-term effects of this alternative upon sensitive species habitat would be slightly lower than those for Alternative 1, due to the lack of aerial spraying. Otherwise, their effects would be similar to those described under Alternative 1.

The probability of disturbance and displacement of sensitive species under this alternative would be smaller than under Alternative 1, due to the lack of aerial spraying. Some disturbance and displacement of sensitive species could still result from weed treatments, but the effects would be temporary and localized. As described in Alternative 1, mitigation measures would be applied to prevent disturbance to breeding goshawks.

Cumulative Effects – Sensitive Species

Sensitive Species, Cumulative Effects - Alternative 1 (Proposed Action)

Cumulative effects to sensitive species resulting from herbicide use in this alternative would be similar to those described under Alternative 3 (No Action), because the herbicides proposed for use are rapidly excreted and do not bio-accumulate. Cumulative effects resulting from disturbance would be slightly greater than other alternatives due to the larger area of treatment proposed, but would still have minimal impacts. This alternative would have the greatest probability of containing the spread of weeds, and would do the most to maintain suitable native vegetation that provides habitat for sensitive species. Cumulative impacts on sensitive species habitat over the next 15 years would be lowest under this alternative.

Sensitive Species, Cumulative Effects - Alternative 2 (No Herbicides)

No herbicides would be used, so there would be no cumulative toxic effects. Disturbance from weed treatment activities proposed under this alternative would have the least cumulative effects on sensitive species because it would involve the fewest activities with the potential to cause disturbance. This alternative would contribute more to cumulative effects on sensitive species habitat than all other alternatives because it would be the least likely to contain the spread of weeds and continued habitat degradation would result over the next 15 years.

Sensitive Species, Cumulative Effects - Alternative 3 (No Change from Current Management)

The analysis area for sensitive species was Madison, Gallatin, Park, Sweet Grass, Carbon, and Meagher Counties, Montana. This area was chosen because it is a large area that provides a full variety of the habitats available to the wolverine, peregrine falcon, northern goshawk, western big-eared bat, and flammulated owl in southwest Montana. The temporal bounds for the analysis were the past 10 years and 15 years into the future, because weed infestations have changed rapidly and it is difficult to predict how their spread beyond that timeframe would affect sensitive species habitat.

Weed control with herbicides is an activity that has been occurring for years in the analysis area, and undoubtedly will continue for many years into the future. Private landowners, county governments, and other state and federal agencies all use herbicides to control weeds. However, the herbicides proposed for use are water-soluble and do not bio-accumulate. Although they may occasionally contact herbicides, no toxic cumulative effects to the wolverine, peregrine falcon, northern goshawk, western big-eared bat, and flammulated owl are expected under this alternative.

The continued spread of weeds on other public and private lands would lead to loss of native vegetation that supports prey populations for the wolverine, peregrine falcon, northern goshawk, western big-eared bat, and flammulated owl. Forest Service projects such as timber sales and prescribed fires, road maintenance, recreational activities and vehicle use, special use permits (both recreation events and non-recreation), livestock grazing, and summer home residence may contribute to the spread of weeds. Recently adopted Best Management Practices (Forest Service Manual 2080) for preventing weed spread are incorporated as mitigation measures in project plans, which would help limit weed spread from Forest Service actions. This alternative would contribute somewhat to cumulative effects on these species because it would be insufficient to contain most weed infestations and continued habitat degradation would result, although the degree to which populations of sensitive species would be impacted is difficult to predict.

Disturbance from human activities has been identified as a problem for some sensitive species, such as the western big-eared bat (Reel et al. 1989, page 39). Although a variety of sensitive species are subject to disturbance from human activities, the impacts of these effects are unknown. Disturbance from weed treatment activities proposed under this alternative would have very low cumulative effects on sensitive species due to the very small area that would be treated compared to the large area subject to disturbance by other human activities.

Sensitive Species, Cumulative Effects - Alternative 4 (No Aerial Application)

The herbicides proposed for use are water-soluble and do not bio-accumulate, so cumulative toxic effects to sensitive species resulting from bio-accumulation would not occur. The potential for disturbance and displacement would be greater compared to the No Action Alternative, but would still have slight cumulative effects because of the very small area that would be treated compared to the large area subject to disturbance by other human activities. This alternative would contribute less to cumulative effects on sensitive species than the No Action Alternative because it would be more likely to contain the spread of weeds and maintain native vegetation.

Direct and Indirect Effects – Management Indicator Species

Management Indicator Species (MIS) - Herbicide Toxicity, Alternative 1 (Proposed Action), Direct and Indirect Effects

The chances of elk contacting herbicides would be greater under this alternative than for all other alternatives, because this alternative proposed the most herbicide use. Most herbicide use would occur in elk habitat, and elk would be likely to occasionally ingest sprayed vegetation or walk through vegetation that had been sprayed. There would be a small additional risk of elk being directly sprayed during aerial herbicide application. The toxicity of herbicides proposed for use is low, as are the chances of elk receiving doses great enough to cause toxic effects. However, this must be qualified by the fact that there is uncertainty regarding the toxicity of some herbicides and inert ingredients.

Management Indicator Species (MIS) - Habitat Modification, Alternative 1 (Proposed Action), Direct and Indirect Effects

This alternative would involve the greatest short-term impacts but also the most long-term benefits to elk populations, because this alternative proposed the most acreage of weed treatment. Forage availability would temporarily decrease in areas treated with herbicides, but would begin recovering within two to three years of herbicide treatment (Rice et al. 1997, page 631). Over the long term, fewer acres of weeds would go untreated under this alternative than for all others.

Management Indicator Species (MIS) - Disturbance And Displacement, Alternative 1 (Proposed Action), Direct and Indirect Effects

The probability of disturbance and displacement of elk under this alternative would be slightly larger than under Alternative 4 (No Aerial Application), due to the use of aerial spraying. The effects would still be temporary and localized due to the short duration of aerial spraying.

Management Indicator Species (MIS) - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 2 (No Herbicides), Direct and Indirect Effects

There would be no toxic effects to MIS under this alternative because no herbicides would be used.

The short-term effects to elk habitat would be less than under all other alternatives because biocontrol using species-specific agents rather than broad-spectrum herbicides that kill a variety of plants would be the most widespread treatment method. Long-term negative impacts to elk habitat would be greater for this alternative than all others, because the treatments proposed would be the least likely to contain the spread of weeds.

The potential for disturbance or displacement of elk would be very low because biological control would be the treatment method affecting the most acres. Little human activity is associated with biological control.

Management Indicator Species (MIS), Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 3 (No Change from Current Management), Direct and Indirect Effects

The chances of elk contacting herbicide would be lower than under Alternative 1, because the number of acres treated would be lower. The chances of elk experiencing toxic effects if they did contact herbicides are low, and are described in detail under Alternative 1.

Under this alternative, there would be a smaller short-term loss of elk forage in areas treated with herbicides until native vegetation began recovering within 2-3 years of herbicide treatment (Rice et al. 1997, page 631) compared to Alternative 1. Degradation of elk winter ranges on the Forest would likely lead to lower long-term elk populations compared to Alternative 1, because the treatments proposed would less effective at containing the spread of weeds.

Some disturbance and displacement of elk would be expected to result from weed treatments. These effects would be temporary and localized, and adjacent areas would normally contain suitable habitat for displaced animals.

Management Indicator Species (MIS) - Herbicide Toxicity, Habitat Modification, Disturbance and Displacement – Alternative 4 (No Aerial Application), Direct and Indirect Effects

The chances of elk contacting herbicide would be slightly lower than under Alternative 1, because there would be no aerial spraying. The chances of elk experiencing toxic effects if they did contact herbicides are low, and are described in detail under Alternative 1.

The short and long-term effects of this alternative would be similar to those under Alternative 1. The difference is that no aerial spraying would occur, so over the short term there would be fewer acres of vegetation impacted by herbicides but over the long-term treatments would be less successful at maintaining native forage plants on important elk winter ranges.

Disturbance and displacement of elk would be similar to that described under Alternative 1, only slightly lower due to the lack of aerial spraying.

Cumulative Effects - Management Indicator Species

Management Indicator Species, Cumulative Effects - Alternative 1 (Proposed Action)

Cumulative effects to elk resulting from herbicide use in this alternative would be similar to those described under Alternative 3 (No Action), because the herbicides proposed for use are rapidly excreted and do not bio-accumulate. Cumulative effects resulting from disturbance would be slightly greater than other alternatives due to the larger area of treatment proposed, but would still have minimal impacts. This alternative would have the greatest probability of containing the spread of weeds, and would do the most to maintain quality elk winter range within the analysis area. Cumulative impacts on elk habitat over the next 15 years would be lowest under this alternative.

Management Indicator Species, Cumulative Effects - Alternative 2 (No Herbicides)

No herbicides would be used, so there would be no cumulative toxic effects. The potential for disturbance and displacement of elk would be minimal and contribute the least towards cumulative effects on elk compared to all other alternatives. This alternative would contribute more towards cumulative effects on elk habitat than all other alternatives because it would be the least likely to contain the spread of weeds in elk winter range.

Management Indicator Species, Cumulative Effects - Alternative 3 (No Change from Current Management),

Cumulative effects to elk were analyzed for the Madison, Gallatin, Bridger, Emigrant, Absaroka, and Crazy Elk Management Units (EMU's). EMU's were delineated in the Statewide Elk Management Plan for Montana as a collection of hunting districts that share similar ecological conditions and encompass the yearlong range of major elk populations (Youmans 1992, page 3). This area was chosen because it contains all seasonal ranges for elk on the Gallatin National Forest. The temporal bounds for the analysis were the past 10 years and 15 years into the future, because weed infestations have changed rapidly and it is difficult to predict how weed spread beyond that timeframe would affect elk habitat.

Weed control with herbicides is an activity that has been occurring for years in the analysis area, and undoubtedly will continue for many years into the future. Private landowners, county governments, and other state and federal agencies all use herbicides to control weeds. However, toxic effects to elk associated with this use have not been identified. The herbicides proposed for use are water-soluble and do not bio-accumulate, so cumulative toxic effects to elk resulting from bio-accumulation under this alternative would not occur.

A large variety of human activities occur in the analysis area, many of which have the potential to disturb or displace elk. Disturbance from weed treatment activities proposed under this alternative would have very low cumulative effects on elk due to the small number of acres that would be treated compared to the large area subject to disturbance by other human activities.

Elk populations are generally robust in the analysis area. Private land development is probably the main threat, but public land winter range is also available. The quality of public lands winter ranges may become more important in the future as private lands winter ranges are lost to development. Forest Service projects such as timber sales and prescribed fires, road maintenance, recreational activities and vehicle use, special use permits (both recreation events and non-recreation), livestock grazing, and summer home residence may contribute to the spread of weeds. The continued spread of weeds on elk winter ranges will likely decrease forage availability and ultimately elk populations in the future. Recently adopted Best Management Practices (Forest Service Manual 2080) for preventing weed spread are incorporated as mitigation measures in project plans, which would help limit weed spread from Forest Service actions. The continued spread of weeds on elk winter ranges could decrease forage availability and ultimately elk populations within the next 15 years, and this alternative could therefore contribute to cumulative effects on elk.

Management Indicator Species, Cumulative Effects - Alternative 4 (No Aerial Application)

The herbicides proposed for use are water-soluble and do not bio-accumulate, so cumulative toxic effects to elk resulting from bio-accumulation would not occur. The potential for disturbance and displacement would be greater compared to the No Action Alternative, but would still have discountable cumulative effects because of the very small area that would be treated compared to the large area subject to disturbance by other human activities. This alternative would contribute less towards cumulative effects on elk habitat than Alternative 3 (No Action) because it would be more likely to contain the spread of weeds in elk winter range over the next 15 years.

Direct and Indirect Effects – Migratory Birds and Biodiversity

Migratory Birds and Biodiversity - Herbicide Toxicity, Alternative 1 (Proposed Action), Direct and Indirect Effects

The probability would be greater for this alternative than for all other alternatives that migratory birds would come into contact with herbicides. Many species of birds inhabiting grasslands and sagebrush shrubsteppe habitats would be likely to ingest herbicides by consuming prey or plant matter that had been sprayed. Dermal absorption of herbicides through contact with treated vegetation would also occur. These habitats would also be the most likely to be subjected to aerial spraying. The toxicity of herbicides proposed for use is low, as are the chances of these species receiving doses great enough to cause toxic effects. However, this must be qualified by the fact that there is uncertainty regarding the toxicity of some herbicides and inert ingredients.

Migratory Birds and Biodiversity - Habitat Modification, Alternative 1 (Proposed Action), Direct and Indirect Effects

Temporary impacts on vegetation resulting from weed treatment could cause localized decreases in biodiversity and the abundance of insects, birds, small mammals, and seeds that are essential forage for migratory birds. Cover for nesting and protection from predators would decrease. These short-term impacts would be larger than under all other alternatives because the largest number of acres would be treated. However, cover and forage would begin recovering in treated areas within two to three years of herbicide treatment (Rice *et al.*, 1997, page 631). This alternative proposed the most aggressive treatment of weeds, and therefore the most long-term benefit to migratory birds by maintaining native vegetation, as discussed in Chapter 3, page 3-33.

Migratory Birds and Biodiversity - Disturbance And Displacement, Alternative 1 (Proposed Action), Direct and Indirect Effects

Because of the large area proposed for treatment compared to the No Change from Current Action Alternative, disturbance and displacement of migratory birds would be more likely to occur. Weeds treatment by people on foot and on ATV's would displace some nesting birds in sagebrush or grassland habitats, and nests would occasionally be destroyed or abandoned. Nests of smaller passerine species such as sprague's pipits, lark sparrows, and Brewer's sparrows are difficult to detect and would occasionally be destroyed by being stepped or driven on. These would be isolated incidents and would have minimal impact on populations of the species involved. There would be additional disturbance resulting from aerial spraying, but this would be temporary and localized. Nest abandonment would be unlikely to result from aerial spraying.

Migratory Birds and Biodiversity - Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 2 (No Herbicides), Direct and Indirect Effects

There would be no toxic effects to birds under this alternative because no herbicides would be used.

The short-term impacts of weed treatment on biodiversity, forage availability, and cover would be less than all other alternatives because biocontrol using species-specific agents rather than broad-spectrum herbicides that kill a variety of plants would be the most widespread treatment method. The long-term availability of forage and cover for birds inhabiting grassland and sagebrush habitats would likely decline the most under this alternative, along with biodiversity, because the treatments proposed would be the least likely to maintain and restore native vegetation.

The potential for disturbance or displacement of migratory birds would be very low because biological control would be the treatment method affecting the most acres. Little human activity is associated with biological control.

Migratory Birds and Biodiversity, Herbicide Toxicity, Habitat Modification, and Disturbance and Displacement, Alternative 3 (No Change from Current Management), Direct and Indirect Effects

The chances of migratory birds contacting herbicide would be lower than under Alternative 1, because the number of acres treated would be lower and no aerial spraying would occur. The chances of them experiencing toxic effects if they did contact herbicides are low, and are described in detail under Alternative A.

Temporary impacts on cover and forage for migratory birds would be lower than under Alternative 1, due to the lower number of acres treated. In the long-term, forage availability and cover for these species would also be lower because the treatments would be less effective at limiting the spread of weed infestations. Weeds would continue to out-compete native vegetation in many areas, leading to decreased biodiversity, along with less cover and forage for migratory birds in grassland and sagebrush steppe habitats.

The probability of disturbance and displacement of migratory birds under this alternative would be smaller than under Alternative 1, due to the lower number of acres proposed for treatment and the lack of aerial spraying. As described in detail under Alternative 1, some disturbance and displacement of sensitive species could still result from weed treatments but the effects would be temporary and localized.

Migratory Birds and Biodiversity - Herbicide Toxicity, Habitat Modification, Disturbance and Displacement – Alternative 4 (No Aerial Application), Direct and Indirect Effects

The chances of migratory birds contacting herbicide would be lower than under Alternative 1 because the number of acres treated would be lower and no aerial spraying would occur. The chances of them experiencing toxic effects if they did contact herbicides are low, and are described in detail under Alternative 1.

Temporary impacts on cover and forage for migratory birds would be slightly lower than under Alternative 1, due to the lack of aerial spraying. In the long-term, forage availability and cover for these species would also be slightly lower because the treatments would be less effective at limiting the spread of weed infestations.

The potential for disturbance and displacement of migratory birds under this alternative would be similar to that under Alternative 1 because the number of acres treated would be similar. The main difference is that there would be no aerial spraying, so overall disturbance would be slightly lower.

<u>Cumulative Effects – Migratory Birds and Biodiversity</u>

Migratory Birds and Biodiversity, Cumulative Effects - Alternative 1 (Proposed Action)

Cumulative effects to migratory birds resulting from herbicide use in this alternative would be similar to those described under Alternative 3 (No Action), because the herbicides proposed for use are rapidly excreted and do not bio-accumulate. The potential for cumulative effects resulting from disturbance would be slightly greater than other alternatives due to the larger area of treatment proposed, but would still have minimal impacts. This alternative would have the greatest probability of containing the spread of weeds, and would do the most to maintain biodiversity and suitable native vegetation that provides habitat for migratory birds within the analysis area. Cumulative impacts on migratory bird habitat over the next 15 years would be lowest under this alternative.

Migratory Birds and Biodiversity, Cumulative Effects – Alternative 2 (No Herbicides)

No herbicides would be used, so there would be no cumulative toxic effects. Disturbance from weed treatment activities would contribute very little towards cumulative effects on migratory birds, because the lowest amount of potentially disturbing activities would be involved compared to all other alternatives. This alternative would have the greatest cumulative effects on migratory birds and biodiversity because it would be the least likely to contain the spread of weeds and maintain native vegetation within the analysis area.

Migratory Birds and Biodiversity, Cumulative Effects - Alternative 3 (No Change from Current Management)

The analysis area for migratory birds was Madison, Gallatin, Park, Sweet Grass, Carbon, and Meagher Counties, Montana. This area was chosen because it is a large area that provides a full variety of the habitats available to migratory birds in southwest Montana. The temporal bounds for the analysis were the past 10 years and 15 years into the future, because weed infestations have changed rapidly and it is difficult to predict how weed spread beyond that timeframe would affect migratory bird habitat.

Weed control with herbicides is an activity that has been occurring for years in the analysis area, and undoubtedly will continue for many years into the future. Private landowners, county governments, and other state and federal agencies all use herbicides to control weeds. Other pesticides including organophosphates and carbamates that have been implicated in migratory bird mortality are in use in the area (Greater Yellowstone Bald Eagle Working Group 1996, page 15). However, the herbicides proposed for use are water-soluble and do not bio-magnify. Therefore, the herbicide treatments proposed under this alternative would not contribute to toxic cumulative effects to migratory birds resulting from other pesticide use.

A large variety of human activities occur in the analysis area, many of which have the potential to disturb or displace migratory birds. Disturbance from weed treatment activities proposed under this alternative would have very low cumulative effects on migratory birds due to the small number of acres that would be treated compared to the large area subject to disturbance by other human activities.

The continued spread of weeds on other public and private lands would lead to loss of biodiversity and native vegetation that provides essential habitat for migratory birds. Forest Service projects such as timber sales and prescribed fires, road maintenance, recreational activities and vehicle use, special use permits (both recreation events and non-recreation), livestock grazing, and summer home residence may contribute to the spread of weeds. Recently adopted Best Management Practices (Forest Service Manual 2080) for preventing weed spread are incorporated as mitigation measures in project plans, which would help limit weed spread from Forest Service actions. This alternative would contribute somewhat to cumulative effects on migratory birds because it would be insufficient to contain most weed infestations and continued habitat degradation would result, although the degree to which migratory bird populations would be impacted is difficult to predict.

Migratory Birds and Biodiversity, Cumulative Effects - Alternative 4 (No Aerial Application)

The herbicides proposed for use are water-soluble and do not bio-accumulate, so cumulative toxic effects to migratory birds resulting from bio-accumulation would not occur. The potential for disturbance and displacement of migratory birds would be greater compared to Alternative 3 (No Action), but would still have discountable cumulative effects because of the very small area that would be treated compared to the large area subject to disturbance by other human activities. This alternative would contribute less towards cumulative effects on migratory bird habitat and biodiversity than Alternative 3 (No Action) because it would be more likely to contain the spread of weeds and maintain native vegetation within the analysis area over the next 15 years.

Table 4-12. Summary of the potential risk of toxic effects to wildlife resulting from herbicide use under each of the alternatives.

	Alt. 1 - Proposed Action	Alt. 2–No herbicides	Alt. 3 -No Action	Alt. 4 – No Aerial Application
Grizzly Bear	Low*	None	Low	Low
Gray Wolf	Low	None	Low	Low
Bald Eagle	Low	None	Low	Low
Sensitive Species+	Low	None	Low	Low
MIS (elk)	Low	None	Low	Low
Migratory Birds	Low	None	Low	Low

*Low risk means that animals may contact herbicides but are unlikely to experience toxic effects due to the low toxicity of herbicides proposed for use. No risk means that animals would not contact herbicide.
+Goshawk, peregrine falcon, flammulated owl, wolverine, western big-eared bat

Table 4-13. Summary of the potential effects weed management alternatives on wildlife habitat under each of the alternatives. Effects were a combination of short-term impacts of the treatments versus the long-term impacts of invasive weeds.

	Alt. 1 - Proposed Action	Alt. 2–No herbicides	Alt. 3 -No Action	Alt. 4 – No Aerial Application
Grizzly Bear	Low*	Moderate	Moderate	Low
Gray Wolf	Low	High	Moderate	Low
Bald Eagle	None	None	None	None
Sensitive Species+	Low	Moderate	Moderate	Low
MIS (elk)	Low	High	Moderate	Low
Migratory Birds	Low	Moderate	Moderate	Low

*Low means that negative effects to populations of the species would be unlikely to occur. Moderate means that negative effects to populations of the species could occur but the likelihood is uncertain. High means that negative effects to populations of the species would be likely to occur.
+Goshawk, peregrine falcon, flammulated owl, wolverine, western big-eared bat

Table 4-14. Summary of the potential disturbance and displacement effects on wildlife under each of the alternatives.

	Alt. 1 - Proposed Action	Alt. 2–No herbicides	Alt. 3 -No Action	Alt. 4 – No Aerial Application
Grizzly Bear	Moderate*	Low	Low	Moderate
Gray Wolf	Low	Low	Low	Low
Bald Eagle	Moderate	Low	Low	Moderate
Sensitive Species+	Moderate	Low	Low	Moderate
MIS (elk)	Moderate	Low	Low	Moderate
Migratory Birds	Moderate	Low	Low	Moderate

*Low impact means that animals may occasionally be disturbed or displaced, but with mitigation incorporated these effects would be discountable. Moderate impacts mean that animals would likely be disturbed or displaced by project activities, but effects would still be minimal with mitigation applied.
+Goshawk, peregrine falcon, flammulated owl, wolverine, western big-eared bat

Consistency with Forest Plan and other Laws, Regulations and Policies - Wildlife

The Gallatin Forest Plan (USFS, 1987, page II-18) contains a Forest-wide standard stating that "big game winter range will be managed to meet the forage and cover needs of deer, elk, moose and other big game species in coordination with other uses. Habitat for deer and elk will be managed to provide for slight increases in populations." Additionally, the Forest Plan (USFS, 1987, pages II-3 and II-4) has objectives that "management of wildlife habitat will emphasize forage and cover needs on big game winter ranges", and "non-game and small game needs will be enhanced by providing for vegetative diversity and protecting special habitat components." Alternatives 1 and 4 would best meet the intent of these standards and objectives by doing the most to maintain native vegetation that is a critical habitat component for most wildlife.

All alternatives would be consistent with the Migratory Bird Treaty Act, the Final Conservation Strategy for Grizzly Bears within the Greater Yellowstone Area (IGBC, 2003, page 41), and the Greater Yellowstone Bald Eagle Management Plan (Greater Yellowstone Bald Eagle Working Group, 1996, pages 24-25). A Biological Assessment discussing effects of the Preferred Alternative will be prepared and submitted to the U.S. Fish & Wildlife Service to comply with the Endangered Species Act.

WILDERNESS AND INVENTORIED ROADLESS AREAS

Direct and Indirect Effects, Alternative 1 (Proposed Action), Wilderness And Inventoried Roadless Areas

Weeds in Wilderness would not be treated with aerial applications of herbicides in this alternative (or any alternative considered in this decision).

Aerial applications would be considered in roadless lands on 67.3 acres of yellow toadflax near West Yellowstone. The activity would be of short duration, less than one day, and is not adjacent to Wilderness area.

Natural Integrity and Apparent Naturalness

Where weed treatment is effective, there will be short-term evidence including dead or wilting plants and areas of disturbed soils where plants have been pulled up or grubbed out. Where plants are dead or dying, and spraying was marked with dye, some people may recognize the weeds were sprayed, which may not appear natural.

This alternative would be the most aggressive and effective alternative in controlling weeds in Wilderness and roadless, because of the multi-faceted treatment options (including herbicides), and the larger number of acres treated. This alternative would create the most improvements in natural integrity by restoring native vegetation to weed infested sites.

In Wilderness, 665 acres of herbicide treatment could occur initially. Approximately 597 acres would be treated with herbicides in Inventoried Roadless Areas (IRAs). The effects on natural integrity would be an overall improvement of these areas as invading noxious weeds are excluded from wildlands and replaced with native plants (see the vegetation section). Apparent naturalness of treatment areas will improve as the evidence of noxious weeds decreases and is replaced with native vegetation. See the effects discussions under vegetation, wildlife and fish, and watershed for an estimate of the direct effects to these resources.

Herbicide treatment would decrease establishment and expansion of aggressive species in wildland areas, and reduce weed related impacts. The visual impact of spraying would be temporary and on most sites only last a few hours or less. Dying and wilting weed plants following herbicide treatment could be apparent. However, this appearance would be short-lived as surrounding vegetation would screen dead plants or blend in with native vegetation, as it grew dormant. Some desirable native vegetation could also be killed along with the weeds depending on the type of herbicide used.

Biological control with insects would only be used on large established weed patches, and would not be noticeable. Some people may notice areas where weeds were pulled, but it would likely not affect the apparent naturalness of the areas.

Cultural control would consist of treating cheatgrass with herbicide and then planting native grasses on 94 acres in the Wilderness and approximately 881 acres in roadless areas. These acres are scattered over a large area, with numerous small patches. The treatment would utilize hand crews to treat the weeds and plant the grass seed. Treatments would take only a few days work on each site to complete, and the size of the treatment will depend upon available funds.

Remoteness and Solitude

Aerial spraying would not occur in Wilderness areas.

Aerial spraying of herbicides within Inventoried Roadless areas would reduce feelings of remoteness and solitude during the one day within each area required to accomplish this work. Public traffic would be limited to these areas during spraying – which would help mitigate any effect to the sense of remoteness or solitude. The public may encounter weed crews during hand spraying operations in Wilderness, or roadless lands, which may affect some people's sense of remoteness, and their opportunity for solitude. This effect would be very short term (typically only several days), and backcountry crews treating weeds would be small (typically 1-4 people).

The use of biological controls would not affect remoteness or solitude. Where weeds are pulled by hand, or chopped/grubbed recreationists may happen upon a work crew and have a reduced feeling of solitude. Treating large infestations with mechanical treatments would require larger crews and longer stays than treating with herbicides, which may have a greater effect on the sense of remoteness and opportunities for solitude. Again, impacts would be short term, with crews being in one area typically no longer than a week.

Grazing as a weed treatment method is only proposed along the Gallatin River (near Decker Flat or Karst Ranch), and this site is not within Wilderness or Inventoried Roadless Areas.

Primitive Recreation Opportunities

With aerial herbicide application, treated areas would be closed to public use until it is safe for them to enter these areas, thus restricting the overall recreational opportunity during this time. Treatment would most likely occur during spring through fall. The public would be kept out of treatment areas for approximately 24-48 hours at a time, reducing opportunities for recreation during those periods.

Mechanical or biological treatments, because of their limited extent and minor impacts, will not impact opportunities for primitive recreation.

Table 4-15. Summary of acres by treatment type for Wilderness and Roadless Areas.

Alternative 1: Proposed Action		
Wilderness	**Treatment Type**	**Acres**
	Aerial	0
	Biological Control & Herbicides	331.9 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax
	Cultural Treatment & Herbicide	94.8 ac., cheatgrass
	Herbicide	665.5*
	Mechanical Treatment & Herbicide	2.4
Roadless	**Treatment Type**	**Acres**
	Aerial	67.3 ac., Dalmatian toadflax
	Biological Control & Herbicides	229.1 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax
	Cultural Treatment & Herbicide	881.4 ac., cheatgrass
	Herbicide	597.4
	Mechanical Treatment & Herbicide	6.9
Alternative 2: No Herbicides		
Wilderness	**Treatment Type**	**Acres**
	Biological Control	721.3 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax
	Cultural Treatment	94.8 ac., cheatgrass
	Mechanical	3.9
	No Treatment	274.7
Roadless	**Treatment Type**	**Acres**
	Biological Control	557.3 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax
	Cultural Treatment	881.4 ac., cheatgrass
	Mechanical	13.7
	No Treatment	329.6

Alternative 3: No Action, No Change from Current Management		
Wilderness	**Treatment Type**	**Acres**
	Biological Control & Herbicides	50.0 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax (limited to the currently approved East Dam treatment area).
	Herbicide	20
	Mechanical Treatment & Herbicide	13.3
	No Treatment	1011.9
Roadless	**Treatment Type**	**Acres**
	Biological Control & Herbicides	42.1 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax
	Herbicides	59.0
	Mechanical & Herbicides	0.4
	No Treatment	1680
Alternative 4: No Aerial		
Wilderness	**Treatment Type**	**Acres**
	Biological Control & Herbicides	331.9 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax
	Cultural Treatment & Herbicide	94.8 ac., cheatgrass
	Herbicide	665.5*
	Mechanical Treatment & Herbicide	2.4
Roadless	**Treatment Type**	**Acres**
	Biological Control & Herbicides	294.1 ac., Canada thistle, musk thistle, spotted knapweed and Dalmatian toadflax
	Cultural Treatment & Herbicide	881.4 ac., cheatgrass
	Herbicide	597.4
	Mechanical Treatment & Herbicide	6.9
	No Treatment	2.3

* Note: see mitigation common to all alternatives. This acreage figure in Table 6 represents the current inventory of weeds where herbicides are the most effective treatment option. In all applications a "minimum tool analysis" would be used to determine the treatment option which would have the least impact on Wilderness values while effectively controlling the weeds which may include a combination of herbicides, biological, or mechanical treatments. See appendix G for an example of a minimum tool decision tree.

Direct and Indirect Effects, Alternative 2 (No Herbicide), Wilderness And Inventoried Roadless Areas

The effects between Alternatives 2 and 3 differ in that no herbicide would be used, resulting in more acres (721 acres of thistle and knapweed in the Wilderness and 557 acres in roadless) being treated with biological controls, 94 acres of cultural treatment in the Wilderness, and 881 acres in Inventoried Roadless Areas (plant native grass species in areas with cheatgrass). See Table 4-15. The effectiveness of both treatment types will be compromised because herbicides would not be used to suppress the established weeds.

The deliberate introduction and establishment of natural weed enemies (biological controls) are designed to reduce the plant's competitive or reproductive capacities. Its purpose is generally not eradication, but rather a reduction in densities and rate of spread kept at an acceptable level. It has been argued that introduction of an exotic insect into a Wilderness setting is a human manipulation of a natural process. Biological controls have a different magnitude of effect on the resource than do encroaching weeds. The weeds affect everything in a naturally functioning system from wildlife populations, to water runoff patterns. The exotic insects only directly affect the host weed species. This method is most effective on dense weed infestations over large areas, and would thus have limited effectiveness in the Absaroka Beartooth or Lee Metcalf Wilderness Areas where target species are localized and in small patches.

In that biological controls would likely have limited application in Wilderness, the effects between Alternative 3 (No Action) and this alternative are largely the same.

Natural Integrity and Apparent Naturalness

This alternative has the potential to have the largest negative effect on naturally functioning ecosystems, and apparent naturalness in Wilderness and roadless lands. Weeds would only be treated with mechanical or biological controls in this alternative, both of which have limited applications for some species. Weeds would eventually occupy all suitable habitats, significantly changing the natural integrity of these lands and their apparent naturalness. See the vegetation section for a thorough discussion of uncontrolled weed population direct effects on the ecosystem, and the discussion under Alternative 3.

Remoteness and Opportunities for Solitude

Effects to remoteness and solitude under this alternative would be limited to backcountry recreationists encountering weed control crews who were primarily treating weeds with mechanical methods. The effect would be short term and isolated. Recreationists would not encounter any weed spraying crews, nor aerial applications in this alternative. Treating large infestations with mechanical treatments would require larger crews and longer stays than treating with herbicides, which may have a greater effect on the sense of remoteness and opportunities for solitude by increasing chances for encounters. Again, impacts would be short term, with crews in one area typically no longer than one week.

Direct and Indirect Effects, Alternative 3 (No Change from Current Management), Wilderness And Inventoried Roadless Areas

Noxious weed control in Wilderness is currently only accomplished by hand grubbing and pulling. Hand control projects have focused on pulling only small patches of mullein, houndstongue, and spotted knapweed. The Forest currently has no blanket authority to use herbicides for weed control in Wilderness. Typically, less than two acres are treated per year in Wilderness using hand control methods (pulling, grubbing and packing out weeds). Under this alternative 1,011 acres would likely not be treated because they were not covered under previous NEPA decisions for use of herbicides. Focused information and education programs, hand control projects, strict controls on weed free feed requirements for recreational livestock have all had limited success in controlling the advancement of noxious weed infestations in Wilderness. Monitoring over the last several decades proves that weed populations are expanding despite these efforts at education and hand eradication.

The East Dam knapweed infestation on the Livingston RD is one exception to the "no herbicide treatments" in Wilderness under this alternative. Currently clopyralid (a selective herbicide that only kills plants in the following families: *Asteracea, Fabaceae,* and *Polygonaceae*) is being used to treat 20 acres under a stand alone NEPA decision to treat knapweed (USDA, 1992). The East Dam EA also allows for 13 acres to be treated with hand control methods and biological control insects on 50 acres of spotted knapweed in the Absaroka Beartooth Wilderness.

Limited weed control efforts (101 acres) using herbicides, hand control methods, and biological controls are occurring in the roadless portions of the Forest. Out of the 101 acres, 59 acres of weeds would be treated with herbicides in Inventoried Roadless Areas under this alternative, 42 acres would likely be treated with biological controls and less than one acre per year with mechanical treatments (grubbing, pulling, etc.) See Table 6 for a summary of acres treated within Wilderness and Inventoried Roadless Areas for each alternative.

Natural Integrity and Apparent Naturalness

Expanding weed populations negatively affect the natural integrity of a landscape by displacing native vegetation. This species composition change has a ripple effect throughout the ecosystem. As a weed monoculture develops, natural diversity of plant species is drastically reduced, a direct effect to natural integrity. Weed invasions increase erosion, reduce water quality, and effect indigenous wildlife (Asher, 1995). "Nonnative invasive plants invade Wilderness and other natural areas throughout North America and invasive organisms as a group are now considered the second worst threat to biodiversity, behind only habitat loss and fragmentation"(Randall, 1999).

Under the No Action Alternative noxious weeds would spread at varying rates depending on the weed species, competing vegetation, disturbance history, and presence of vectors (water, recreationists, animals and vehicles). Under this alternative, it is likely that noxious weeds would eventually infest most suitable habitats within Wilderness, including sites that are presently weed-free. In roadless lands, spread would also go largely unchecked, though there is currently limited authority for herbicide control outside of Wilderness. Unchecked spread of noxious weeds would result in the unavoidable deterioration of the natural condition of the Wilderness and adjoining land diminishing the recreational experience and wildland values. Backcountry travelers who are knowledgeable about plant communities would be aware of the changing landscape, and would not meet their expectations for experiencing an intact ecosystem. The intent of the Wilderness Act and the Montana Wilderness Study Act to maintain natural integrity and preserve naturally functioning ecosystems would not be realized with this alternative.

Remoteness and Solitude

Effects to remoteness and solitude under this alternative would be limited to backcountry recreationists encountering weed control crews who were primarily treating weeds with mechanical methods. In some cases recreationists may encounter crews applying herbicides using stock or trail vehicles outside of Wilderness, which could influence a user's sense of remoteness or solitude. These effects would be short term, limited to a few days in the summer. There would be no long term effects to remoteness or opportunities for solitude using either hand control methods, or limited chemical treatments outside of Wilderness.

Direct and Indirect Effects, Alternative 4 (No Aerial Application), Wilderness And Inventoried Roadless Areas

The effects of Alternatives 1 and 4 are identical in designated Wilderness.

Overall the effects of Alternative 1 and Alternative 4 are identical outside of Wilderness with a few exceptions: without the aerial treatment option, backcountry users would never be subjected to the visual/noise intrusions of helicopter or fixed wing spraying operations. This would be an improvement over Alternative 1 in terms of limiting direct effects to opportunities for solitude and a sense of remoteness.

Lack of aerial treatment as an option in this alternative could negatively effect natural integrity of roadless lands over time. Large weed infestations of yellow toadflax and other species may be very difficult to treat with ground spraying methods because of lack of access and steep slopes in some roadless areas. Limited ground treatment with herbicide could allow these populations to grow rapidly, impacting the natural integrity of the landscape. See previous discussions.

Cumulative Effects to Wilderness And Roadless Areas

Several reasonably foreseeable past present and future activities could contribute to cumulative effects to natural integrity, apparent naturalness, opportunities for solitude and remoteness in Wilderness, Wilderness Study Areas and Inventoried Roadless Areas. The analysis area for this discussion is the entire Gallatin National Forest. Effects are similar in all alternatives. Differences in cumulative effects between alternatives are more an issue of magnitude tied primarily to opportunities for solitude, than presence or absence of effect.

Generally speaking, recreation use is increasing on the Gallatin National Forest. Increasing recreational use and its effects have recently been documented in a report written to assess changed condition in the Hyalite Porcupine Buffalo Horn Wilderness Study Area (HPBH) (Schlenker, 2002). Increasing recreation pressure from all sorts of users including hikers, horseback riders, mountain bikers, and off-highway vehicle enthusiasts contribute to a decreased sense of solitude in the Hyalite Porcupine Buffalo Horn Area. Recent land and access acquisitions, have affected the remoteness of the HPBH. These same users are vectors for spreading weeds in the Wilderness Study Area, affecting natural integrity. Elsewhere on the Forest in Wilderness and in Inventoried Roadless lands, recreation use is also increasing with similar effects. Travel management decisions to be made in the near future will affect these use patterns to a degree. Those effects are unknown at this point, as a decision on new travel regulations have yet to be made. The current pattern of increasing motorized recreation use of Forest trails has lead to user conflicts and issues relating to remoteness and opportunities for solitude in the Wilderness Study Area and in Inventoried Roadless Areas. A recent lawsuit, and the current editorial debate in the local newspaper provides testament to the complexity of this issue. Comment received during scoping for the Gallatin Forest Travel Plan revision indicates that spread of weeds, decreasing opportunities for solitude, and maintaining primitive recreation opportunities are issues for many users.

Management of wildfire, Wildland Fire for Resource Benefits, and prescribed fire also has potential cumulative effects on the natural integrity of Wilderness, Wilderness Study Area and Inventoried Roadless Areas. Fire, in whatever form, creates ready seedbeds for weeds to become established. A recent fire located largely within the HPBH burned over 25,000 acres in 2002. This area is ripe for expanding weed infestations. Several other large wildfires have burned on the Forest in the last 5 years. Fire control practices themselves can exacerbate weed problems at camps and staging areas. Prescribed burning can have a similar effect. In addition, fuels are often pretreated in prescribed burn areas, which may negatively affect the apparent naturalness of the area by leaving unnatural appearing stumps and slash. Many forms of fire have the beneficial effects of returning fire – a natural disturbance process – to a landscape that is dependent on fire, helping regenerate healthy stands of native vegetation.

Prevention and education programs, whether with the general public, or with special use permittees have beneficial effects on limiting the spread of weeds on public land. Some special use activities (e.g. range allotments, linear rights of way, recreation events) may have a negative effect on apparent naturalness, the sense of remoteness, opportunities for solitude, and natural integrity in Wilderness Areas, the Wilderness Study Areas, or Inventoried Roadless Areas.

Irreversible and Irretrievable Commitment of Resources

Under Alternatives 2 and 3, once weeds become well established in Wilderness and Inventoried Roadless Areas, eradication would probably never occur, resulting in an irreversible loss of natural integrity and apparent naturalness.

Consistency with Forest Plan and other Laws, Regulations and Policies

All alternatives are consistent with management direction found in the Forest Plan (Management Area 4, page III-10), the Wilderness Act, and proposed Roadless Area Conservation Rule. All alternatives are consistent with FSM 21009.14 (13.4) for pesticide use in wilderness areas as long as the Regional Forester approves the annual pesticide use plan.

WILD AND SCENIC RIVERS

This analysis will examine the potential effects of weed treatments on eligible Wild and Scenic Rivers on the Gallatin National Forest. The issue identified is: would proposed weed treatments effect the outstandingly remarkable values identified for the eligible Wild and Scenic River segments on the Forest thereby potentially affecting their future designation?

Direct and Indirect Effects, Alternative 1 (Proposed Action) and Alternative 4 (No Arial Application), Wild and Scenic Rivers

Effects for Alternatives 1 and 4 are the same, as no aerial spraying is proposed within any eligible Wild and Scenic River Corridor.

There would be no substantial direct effects in Alternatives 1 or 4 to the outstandingly remarkable attributes that make these rivers eligible for inclusion in the system.

Noxious weeds are present along all of these streams, and are prolific along the Gallatin and Boulder Rivers (knapweed and oxeye daisy in particular). Weeds are often spread with water as the vector. These established weed populations are difficult to treat effectively within close proximity to water. To date, only hand pulling treatments have been used. In Alternatives 1 and 4, weeds within 50 feet of these rivers would be treated with herbicides that are approved for aquatic applications. .

Indirectly, the effective treatment of weeds along these corridors would improve scenery, and protect fish and wildlife values by restoring the native vegetation component.

Direct and Indirect Effects, Alternative 2 (No Herbicides) and Alternative 3 (No Change from Current Management), Wild and Scenic Rivers

The effects for Alternatives 2 and 3 would be the same. Under the No Action Alternative (3) no aquatic approved herbicides are currently being used to treat weeds along the river corridor, as would be the case in Alternative 2 – no herbicides at all.

There would be no direct effects to the outstandingly remarkable features of these rivers in either alternative. See the fish and wildlife sections for detailed descriptions of direct effects. Indirectly, the lack of aggressive weed control may affect the natural appearance (scenery) of these corridors, as weeds occupy all suitable habitats. The presence of weeds could have a negative effect on the experience of some recreationists who expect a natural environment without the presence of exotic plant species. Weeds can also increase sediment level, thus effecting fish populations. Also, weeds can decrease forage quality, thus displace wildlife in the river corridor.

Cumulative Effects to Wild and Scenic Rivers

For all alternatives, there is likely to be some cumulative effects within the river corridors as recreation use increases. Increasing recreation use would likely increase the spread of weeds, which would affect the values of scenery, and potentially increase soil erosion which could affect the fishery and wildlife values.

A proposed addition of a hydropower generation plant to the Hegben Lake Dam is being evaluated at this time for its potential to affect the outstandingly remarkable values of recreation and fisheries along the Madison River. Should there be any identified effects, they would have a cumulative effect with unchecked weed infestations that would impact recreation and fisheries.

Consistency with Forest Plan and other Laws, Regulations and Policies

All Alternatives are consistent with the goals and objectives of the Gallatin National Forest Plan for eligible river segments to protect and maintain their potential classification.

RESEARCH NATURAL AREAS

Research Natural Areas (RNA) and Special Interest Areas (SIA) are designated areas representing major, natural timber types or other plant communities in an unmodified condition. Invasive plants and the control of invasive plants may have a detrimental impact on RNAs and SIAs. The East Fork Mill Creek RNA and the Black Sands SIA have invasive plants within and adjacent to these protected areas.

Direct and Indirect Effects, Alternatives 1 (Proposed Action) and Alternative 4 (No Aerial Application)

Both of these alternatives would have the same treatment for the RNA and SIA. Aerial application is excluded from the RNA and SIA (Chapter 2 – Environmental Protection Measures). These alternatives propose to treat weeds that pose a threat to the plant communities within the RNA and SIA. The treatment would involve spot application of herbicide treatment in all RNAs and SIAs at risk to weed invasion.

The overall goal of RNA management is to maintain the full suite of ecological processes associated with the natural communities and conditions for which the RNA is designed to protect. Until recently, the primary course of action was to leave RNAs alone. However, with the emphasis on ecosystem management, more attention is being placed on restoration of natural processes such as fire, and control of invasive alien species, which alter the composition, and functioning of natural communities (Natural Heritage Program 2004). Weed treatments would protect the natural ecological composition of the RNA and SIA, and protect their identified values for research or special interest. Since weeds have been located adjacent to the RNA, effective treatment of those areas would help protect the RNA by helping to eliminate establishment of noxious and invasive weeds within them.

Proposed adaptive management activities include the identification and treatment of weeds that may enter the RNA through natural sources (e.g. wind, wildlife, fire). Following identified mitigation measures, effects from treatment of new locations would be the same as those already identified. If future additional treatment is needed within the RNAs, concurrence of the Research Station Director and the Forest Supervisor will ensure that herbicide use is consistent with FSM and Forest Plan direction.

Direct and Indirect Effects, Alternative 2 (No Herbicides)

Biological control could be used when effective agents are available, however the weeds would always be present (biological control agents never eradicate their host). Effective biological control agents are only available for a few weed species. Mechanical pulling of small patches of non-rhizomatous weeds would be implemented where practical. The majority of our most aggressive weed species spread via their roots so pulling is not an effective method of control unless all of the roots are removed and the patch is very small. Also, extensive ground disturbance within the RNAs or SIA is not appropriate because of the damage to the resource that is being protected. Similarly grazing with sheep or goats is not compatible with the goal of preservation for potential research, so would not be implemented in the RNA or SIA. Under Alternative 2 most weeds would continue to encroach into these areas. This alternative would not provide opportunities to prevent the introduction of noxious weeds.

Direct and Indirect Effects, Alternative 3 (No Change from Current Management)

Neither the RNA or SIA would be treated for weed control, the weeds would continue to expand and diminish the unique plant values within and adjacent to these areas.

Cumulative Effects – Research Natural Areas and Special Interest Areas

Under all alternatives, there are no past, present, or reasonably foreseeable actions that, along with the proposed activities within the RNAs or SIA, would cumulatively increase the risk of noxious weed spread, with the exception of wildfire. Cumulative effects may occur when weed-spreading activities occur next to RNAs. Under Alternatives 1 and 4 effective treatments of weeds would maintain the ecological integrity and research value of the areas. Under Alternatives 2 and 3, the long-term lack of effective treatment of potentially new infestations, along with the likelihood that weeds would eventually spread from outside the RNAs into them, poses a risk to both the research value and biological diversity of RNAs.

Consistency with Laws and Policies – Research Natural Areas and Special Interest Areas

Forest Plan Direction and Individual Establishment Records

All of the alternatives are consistent with the Forest Plan. All alternatives are consistent with direction in the Establishment Records by proposing specific control against target organisms, and by taking measures to control or eradicate these populations.

None of the alternatives contains grazing as a weed control method within RNAs or SIA, which is consistent with Forest Plan Management Area 21 standard (Forest Plan page III-63).

FSM 4063 – Research

Alternatives 1 and 4 would be consistent with the Forest Service Manual 4063 by removing exotic plant or animal life. Alternatives 2 and 3 would either not be consistent with the manual or would be least effective in following management direction.

Mitigation Measures

- If any treatment with herbicide is planned within RNA boundaries, concurrence must be obtained through the Research Station Director and Forest Supervisor. This includes any future treatment need of new infestations. Since SIA are designated by the Forest and not on a Regional level, the Forest Supervisor has authority to approve all projects within the SIA. A concurrence letter from the Research Station Director is not needed for SIA (Steve Shelly, personal communication, 2004).

- No motorized access will be allowed except on the few exceptions where roads exist as identified in the individual establishment record for each RNA or SIA.

- Wilderness area management will take precedence over RNA or SIA direction when proposed weed control activities are identified for an RNA or SIA within designated wilderness boundaries.

- No aerial spraying will be allowed to control any current or future weed infestation unless specific project mitigation is incorporated to meet policy standards and guidelines and concurrence has been obtained through the Research Station Director and Forest Supervisor.

RECREATION

Direct and Indirect Effects - Alternatives 1 (Proposed Action) and Alternative 4 (No Aerial Application), Recreation

Direct and indirect effects on recreation resulting from implementation would include short-term (one to seven days) encounters with herbicide treatment crews, short-term odors from some herbicides, and visual impacts from wilting plants. Additional effects resulting from these alternatives would be the protection of adjacent non-infested areas and preservation of intact plant communities, which would enhance the recreation experience. Concern over herbicides may cause some Forest users to choose to recreation in areas that have not been recently treated with herbicides. All weed treatment activities would be conducted in compliance with Gallatin Forest Travel Plan regulations, which allow for administrative use. When cross-country motorized travel is necessary to facilitate weed control, there will be short-term visual impacts in the form of tracks created by laying down grasses. In dry years, these tracks could remain visible throughout the season. While in wetter years the tracks could be erased, by rains and re-growth, before the fall.

All known weed infestations in dispersed sites, permitted use sites, special use sites, rental cabin sites, summer home sites and campgrounds would be treated in these alternatives. Signs will be posted in recreational areas notifying the public of the herbicide used and stating the safe re-entry period as specified on the herbicide label (usually when the herbicide is dry on the plant surface).

Under Alternatives 1 and 2, herbicide treatments would decrease established and expansion of aggressive weed species into non-infested areas and reduce weed-related impacts on recreation. The visual impact of spraying would be temporary and on most sites only last a few hours. Dying and wilting plants following herbicide treatment would be apparent. However, this appearance would be short-lived as surrounding vegetation would screen dead plants or blend with native vegetation, as it grew dormant.

Long-term improvements include an overall reduction of stiff plant stalks and sharp bristle and increase in the variety and amount of native flora. Treating invasive weeds would be an improvement in the overall quality of the recreational sites. Areas with aerial treatment are not near recreation sites or trails so this activity will not have an impact on recreational users.

Direct and Indirect Effects - Alternative 2 (No Herbicides) and Alternative 3 (No Change from Current Management), Recreation

Under Alternative 2 No Herbicides would be used to treat the weeds so only small infestations would be pulled. Most of the weed patches would not be treated or control would be limited to biological control insects (which have minimal effectiveness). Consequently the long-term impact of limited weed control will be a substantial increase in weed density throughout most recreation sites, which will spread into adjacent areas.

Under Alternative 3 No Change from Current Management, most recreation sites are currently being treated with herbicides and this would continue. Under the Forest Service Manual (1950, 31b.5.a), the chief of the Forest Service has excluded the action of applying registered herbicides in campgrounds or recreation sites from NEPA requirement of a decision document and of a project file (Fed Register Vol. 57, 1992). To comply with the herbicide labels the sites treated in recreational areas will be signed to notify the public of a safe re-entry period (usual when the herbicide has dried on the plant). Roads leading to recreation sites would not be treated so weeds would spread into adjacent areas.

Cumulative Effects - Recreation

Cumulative effects from activities described at the beginning of this chapter would continue to impact recreation, affecting the location where and times when people can recreate at various locations across the Gallatin National Forest without being displaced by herbicide applications. Effects on recreation under any of the alternatives would be minor and short-term (one to seven days). While visitor displacement is the most likely direct effect of weed treatment, short-term (one to three years) visual impacts from cross-country motorized travel for the purpose of herbicide application are also possible. Also, an aggressive weed control program (as in Alternatives 1 and 4) will maintain the native plants and current visual quality of native plant communities. While the less aggressive weed control alternatives (2 and 3) will continue to see an increase in weed species and a decrease in native plants resulting in a diminished visual quality for the landscape.

Consistency with Forest Plan and other laws and Policies – Recreation

All alternatives are consistent with the Forest Plan (Management Area 5, page III-14 & 15). A management goal for Management Area 5 is to “Maintain and improve the wildlife values and the natural attractiveness of these areas to provide opportunities for public enjoyment and safety.” Effects from herbicide treatments will be of short duration, less than one day. Areas inside campgrounds and other developed recreation sites that are treated with herbicides will be posted to notify for public safety.

HUMAN HEALTH

This issue addresses the concern that weed control may have a detrimental impact on human health. More specifically, the impacts that mechanical control such as pulling, and herbicide control (both ground and aerial spraying) may have on human health.

Direct and Indirect Effect, All Alternatives, Mechanical Treatment, Human Health

Potential risks to human health from mechanical weed control methods are very low and include emissions from gasoline or diesel powered equipment, burns, allergies, back injuries and skin irritation from direct contact with plants by individuals doing the work.

Some invasive weed species can cause allergies and minor skin irritations in a few individuals. Some species of invasive weeds, such as thistles, cause minor scrapes and irritations, and there are other more serious complications that may result from hand pulling. For example, leafy spurge contains a latex-bearing sap that irritates human skin and rarely causes blindness in humans upon contact with the eye (Callihan *et al.*, 1991). There have also been claims (not medically supported) that hand pulling of knapweed may result in the formation of tumors on the hands. Highly allergic individuals can have serious complications when exposed to allergens (weeds or pollen), including constriction of the airway and anaphylactic shock, the significance of which should not be underestimated since forest workers would be working some distance from medical assistance.

Approximately 10 to 15 percent of the U.S. population suffers from allergy symptoms from invasive weed species such as knapweed. Knapweed is a common and powerful allergen that peaks in August (Gillespie and Hedstrom, 1979). Allergies to weeds such as knapweed may complicate or trigger asthma. It may take up to two years after getting a person's allergies under control to see a benefit in reduced asthma symptoms (Nielson, 1999).

While there is some potential for health effects associated with mechanical treatment of weeds, required personal protective equipment such as gloves, long sleeved shirts, boots and safety glasses along with personal hygiene, would prevent injuries or irritation, and therefore no human health effects are anticipated by mechanical removal of weeds.

Direct and Indirect Effect, All Alternatives, Cultural Treatments, Health Effects

Potential human health risks associated with cultural control methods include exposure to dust and chaff during seeding operations. Allergic reaction can result from exposure of seed and chaff when handling seeds; however, gloves, long sleeved shirts, boots, and other personal protective equipment, as needed, would prevent injuries or irritations. Therefore, no human health effects are anticipated by cultural control methods.

Direct and Indirect Effect, All Alternatives, Biological Treatments, Health Effects

Biological treatments would result in no known risks to human health.

Direct and Indirect Effect, Alternatives 1, 3 and 4, Herbicide Treatments

The following primary reference literature was used to analyze potential human health risks associated with ground and aerial applications of herbicides:

- The Risk Assessment for Herbicide Use in Forest Service Regions1, 2, 3, 4 and 10, and on Bonneville Power Administration Sites (USFS, 1992).
- Assessing the Safety of Herbicides for Vegetation Management in the Missoula Valley Region – A question and Answer Guide to Human Health Issues, (Felsot, 2001).
- Risk assessments completed by the Forest Service under contract with Syracuse Environmental Research Associates for 2,4-D, picloram, clopyralid, dicamba, hexazinone, sulfometuron methyl, metsulfuron methyl, triclopyr, imazapic, and imazapyr. (USFS, 1995; USFS, 1996c; USFS, 1996d; USFS, 1997a; USFS, 1997b; USFS, 1997c; USFS, 1998a; USFS, 1998b; USFS, 1999a; USFS, 1999b; USFS, 2000b; USFS, 2001a).

Three levels of analyses were used in the above risk assessment process: 1) a review of toxicity test data (i.e., acute, chronic, and sub-chronic) for herbicides proposed for use on the project to determine dosage that could pose a risk to human health; 2) an estimate of exposure levels to which workers (applicators) and general public may be exposed during treatment operations; and 3) comparison of dose levels to toxicological thresholds developed by Environmental Protection Agency to determine potential health risks.

Toxicity test data on laboratory animals is available for herbicides proposed for use in this analysis. Most tests have been conducted under Environmental Protection Agency pesticide registration/re-registration requirements for use in the United States. The Environmental Protection Agency uses test data to determine conditions for use of herbicides in the United States.

Label restrictions on herbicides are developed to mitigate, reduce, or eliminate potential risks to humans and the environment. Label information and requirements include: Personal Protective Equipment; User Safety; First Aid; Environmental Hazards; Directions for Use; Storage and Disposal; General Information; Mixing and Application Methods; Approved Uses; Weeds Controlled; and Application Rates.

Analysis of herbicide use in this EIS assumes compliance with the product label during handling and application. Additional environmental protection measures are typically developed by Forest Resource specialist to further reduce potential risks to human health and the environment during application of herbicides. These measures are implemented during analysis and at time of application to ensure mitigation is greater than required by US Environmental Protection Agency label requirements.

Factors Affecting Hazard Of Herbicide –

1.) Method of Application

How herbicides are applied can have a direct impact on the potential for human health effects. According to the risk assessments completed on herbicide usage on forest lands (USFS, 1995; USFS, 1996c; USFS, 1996d; USFS, 1997a; USFS, 1997b; USFS, 1997c; USFS, 1998a; USFS, 1998b; USFS, 1999a; USFS, 1999b; USFS, 2000b; USFS, 2001a) herbicides applicators are at a higher risk than the general public from herbicide use. The risk assessments compared risks to workers for all types of application, including aerial, backpack, ground-mechanical, and hand applications. Lower risks were estimated for aerial and ground-mechanical application as compared to other methods, even though the total amount of herbicide applied in a given day was higher. Risks associated with backpack and hand application of herbicides were estimated to be the highest, due to workers receiving repeated exposures that may remain on the worker's skin for an extended time period.

The US Environmental Protection Agency, in its re-registration of picloram (US EPA, 1995), also noted that the highest risk for herbicide applicators was for those using the backpack application method. The lowest risk was for aerial and ground-boom applicators.

2.) Length of Exposure

The magnitude of a dose that is hazardous to health depends on whether a single dose is given all at once (acute exposure), multiple doses are given over longer periods (chronic exposure), or regularly repeated doses or exposures over periods ranging form several days to months (sub-chronic). The US Environmental Protection Agency develops reference doses, which are an estimate of a daily dose over a 70-year life span that a human can receive without an appreciable risk of deleterious effects (US EPA, 1989). Reference doses include a "safety factor" where the No Observed Effect Level (NOEL) is divided by a factor, usually 100, to account for uncertainty and hypersensitive individuals. The 100-value is derived by including a safety margin of 10 for extrapolating study results from mammals to humans, and an additional safety factor of 10 for variation in population response to a particular compound.

The reference dose is a conservative threshold of toxicity relative to this analysis because it assumes daily exposure over a 70-year life span. Actual worker exposure for herbicide treatments in this project would typically be between 20 to 80 days each year for substantially less than 70 years. The reference dose is also calculated from the No Observed Effect Level, assuming humans are 100 times more sensitive than animals to the chemical testes.

Potential doses to workers or the public from application of herbicides would be transitory. Lifetime references doses are used here as a convenient and conservative comparison for determining significance of human doses. Lifetime reference dose values are based on daily feeding studies, whereas workers and the general public would not be exposed daily over a lifetime. Maximum duration of exposure for workers on a yearly basis was estimated in the range of 10 to 40 days for commercial applicators (US EPA, 1995). This may be on the lower end of the range as treatments of weeds in spring and fall have become more popular.

3.) Route of Exposure

Substances tested for acute toxicity are usually administered by pumping a chemical down a tube into an animal's stomach. From this route of exposure, an oral LD_{50} (lethal dose that kills 50 percent of a test population, measured in one milligram of herbicide per kilogram of animal weight) can be estimated. Exposure during chronic testing usually involves placing the chemical in the animal's food, and then measuring the amount of food eaten during each 24-hour period (US EPA, 1996a, b).

Test substances are also applied to the shaved skin of an animal to estimate a dermal $LD_{50.}$ About 10 percent of the animal's body surface is exposed to a chemical covered by a patch for 24 hours. In acute exposure studies, whether by oral or dermal routes, animals are monitored for range of adverse responses for 14 days following dosing (US EPA, 1996c).

Skin acts as a protective barrier to limit and slow down movement of a chemical into the body. Studies of pesticides applied to the skin of humans indicate that for many people, only about 10 percent or less passes into the blood. In contrast, adsorption of chemicals from the small intestine is quicker and more complete than from the skin (Ross *et al*., 2000)

Required personal protective equipment used by workers during herbicide application (gloves, waterproof boots, long sleeved shirts and pants) is designed to reduce exposure to sensitive areas on the body. Use of personal protective equipment as required by the Forest Service job hazard analysis would protect worker health.

4.) Toxicity of Herbicides

A comparison of toxicity for typical herbicides is shown in Table 4 –16. Toxicological studies using animals typically involves purposeful exposure to dosages required to cause an effect (i.e. tumors, changes in immunity, etc.), or to establish a Lowest Observed Effect Level (LOEL) or a No Observed Effect Level (NOEL). This often requires administration of relatively high doses of a chemical in order to document an effect or lack thereof. The causal dose in many toxicological studies is significantly greater than what an applicator might be exposed to while applying herbicides or the public may be exposed to walking through a treated field or living adjacent to treated land. Therefore, concluding that an applicator may experience neurological effects because a study in rats showed such connection, may lead to an erroneous conclusion because the dose administered to the rat is in no way representative to what an applicator may be exposed to when applying an herbicide. In addition, the method of exposure to herbicides in animal studies is uniquely different than that of a worker or person of the general public, possibly leading to a causal effect. In animal studies, herbicides are commonly pumped into stomachs, put directly into food, or placed directly on shaved skin. Herbicide applicators and the general public are clothed and do not purposely ingest herbicides under the same conditions as animals studies of toxicological significance.

Table 4-16. Comparison of Herbicide Toxicity.

Herbicide	Carcinogenic[1]	Estimated Exposure to Public[2] Reference Dose (RfD)	Estimated Exposure to Worker[2]	RfD (mg/kg/day)	Mutagenic and Reproductive[3]	Acute oral LD_{50} for Rats (mg/kg/day)
Glyphosate	E	<RfD	<RfD	0.1	No	2,000-6,000
Picloram	E	<RfD	<RfD[6]	0.2	No	3,000-5,000
Hexazinone	D	<RfD	Below to slightly above RfD[7]	0.03/0.05[4]	No	1,690
Clopyralid	E	<RfD	<RfD	0.5	No	2,675-5,000
2,4-D	D	<RfD	Below to slightly above RfD[8]	0.01	No	100-1,800
Dicamba	D	<RfD	<RfD	0.03	No	757-1,701
Chlorsulfuron	E	<RfD	<RfD	0.05	No	>5,000
Metsulfuron methyl	E	<RfD	<RfD	0.25	No to slight	>5,000
Triclopyr	E	<RfD	<RfD	0.005	No to slight	630-729
Sulfometuron methyl	E	<RfD	<RfD	0.02[5]	No	>5,000
Imazapyr	E	<RfD	<RfD	2.5[5]	No	>5,000
Imazapic	E	<RfD	<RfD	0.05	No	5,000

RfD = Reference Dose; Units expressed as milligrams of herbicide per kilogram of body weight = mg/kg; LD_{50} = lethal dose in milligram of herbicide per kilogram of animal weight that kills 50 percent of a test population.

[1] EPA carcinogenicity classification based on daily consumption for a 70- year life span. D = Not Classifiable as to Human Carcinogenicity; E = Evidence of Non-Carcinogenicity.
[2] Exposures under typical exposure scenarios. Accidental and extreme exposure scenarios may exceed the RfD.
[3] Unlikely that compound is mutagenic or would pose a mutagenic risk to humans at expected exposure levels.
[4] Two RfDs reported.
[5] Provisional RfD, US EPA has not derived RfD for this compound.
[6] USFS (1999a) reports that worker wearing contaminated glove may received an adsorbed dose greater than the RfD.
[7] USFS (1997b) reports that worker involved in ground or aerial application of 2,4-D may be exposed to levels above the RfD if effective methods to protect workers and minimize exposure are not employed.

Source: Infoventures 1995a-k; OSU 1996a-h; US EPA, 1990; US EPA, 1990a; USFS, 1995; USFS, 1996b-d; USFS, 1997b-c; USFS, 1998a-b; USFS, 1999a-b; USFS, 2000b; USFS, 2001a

Estimates of exposure to workers and the general public of herbicides applied to forest lands have been reported under various conservative exposure scenarios (USFS, 1995; USFS, 1996c; USFS, 1996d; USFS, 1997a; USFS, 1997b; USFS, 1997c; USFS, 1998a; USFS, 1998b; USFS, 1999a; USFS, 1999b; USFS, 2000b; USFS, 2001a) The most reasonable interpretation of the risks associated with application of most herbicides on forest lands is that, except for accidental exposures or extremely atypical and perhaps implausible exposures scenarios (i.e. acute direct spray entirely covering a naked child), the use of herbicides on forest lands would not pose an identifiable risk to workers or the general public. Exposures under typical exposure scenarios (those following guidelines on the label) would be below the reference dose, a dose level determined to be safe by US Environmental Protection Agency over a lifetime of daily exposure.

There are exceptions worth noting that may help identify protective measures that may help identify protective measures that could be instituted when applying herbicides. USFS (1997b) reports that over a range of plausible application rates, workers may be exposed to hexazinone at levels that exceed the reference dose. Likewise, there is reasonable concern that workers applying triclopyr over a prolonged period of time in the course of a single season and/or several seasons may be at risk of impaired kidney functions (USFS, 1996c). The Forest Service (USFS, 1998a) reports that if 2,4-D were applied directly to fruits and vegetables at anticipated application rates, the consumption of vegetables would be undesirable and could lead to health effects. They point out; however, that the likelihood of such an exposure seems remote when applying on forest lands. Also, the Forest Service (USFS, 1998a) reports that exposure levels for workers involved in ground or aerial application of 2,4-D may exceed the reference dose slightly, based on upper limits of exposure. They go on to indicate that 2,4-D can be applied safely, (exposure doses below the reference dose) if effective methods are used to protect workers and minimize exposure (personal protective equipment). The Forest Service (USFS, 1999a) also reported that there is no evidence that typical exposures to picloram would lead to a dose level that exceeds the reference dose or level of concern with the exception of wearing contaminated gloves for one hour, which results in estimates of absorbed doses that exceed the reference dose.

Acute Toxicity

Acute toxicity is measured by the LD50, defined as the dosage of toxicant expressed in milligrams per kilogram of body weight, which is lethal to 50 percent of animals in a test population within 14 days of administration (USFS, 1992). Since potential exposure levels to workers and the general public associated with use of herbicides on forestlands have been estimated to be at or below US Environmental Protection Agency reference doses, dosages would not exceed acute toxicity dose levels when applying herbicides on forestland.

1.) Sub-Chronic and Chronic Toxicity

There is considerable information on sub-chronic and chronic effects due to exposure to herbicides in controlled animal studies. The information suggests that the herbicides proposed for use by the Forest are not carcinogenic, and there is no evidence to suggest that herbicides proposed for use by the forest would result in carcinogenic mutagenic, teratogenic, neurological or reproductive effects based on anticipated exposure levels to worker and the public (Arbuckle 1999; Charles *et al.*, 1996;Faustini, 1996; Ibrahim *et al.*, 1991; Mattsson, 1997; Mustonen, 1986; Infoventures, 1995a-j; OSU, 1996a-h; US EPA, 1990; US EPA, 1990a; USFS, 1995; USFS, 1996b-d; USFS, 1997a-c; USFS, 1998a-b; USFS, 1999a-c; USFS, 2000b; USFS, 2001a.)

2.) Synergistic Interactions

Concerns are occasionally raised about potential synergistic interactions of herbicides with other herbicides in the environment or when they are mixed during application (tank mixing). Synergism is a special type of interaction in which the combined impact of two or more herbicides is greater than the impact predicted by adding their individual effects. The Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4 and 10 and on Bonneville Power Administration Sites, 1992, addresses the possibility of a variety of such interactions. These include the interactions of the active ingredients in an herbicide formulation with its inert ingredients, the interactions of these herbicides with other herbicides in the environment, and the cumulative impacts of spraying as proposed with other herbicide spraying to which the public might be exposed.

No one can guarantee the absence of a synergistic interaction between herbicides and / or other chemicals to which workers or the public might be exposed. For example, exposure to benzene, a known carcinogen that comprises 1 to 5 percent of automobile fuel and 2.5 percent of automobile exhaust, followed by exposure to any of these herbicides could result in unexpected biochemical interactions (USFS, 1992). Analysis of the infinite number of materials a person may ingest or be exposed to in combination with chemicals is outside the scope of this analysis. That being said, there is some indications that the co-exposure to 2,4-D and picloram may induce effects not associated with 2,4-D or picloram alone (USFS, 1998a; Cox, 1998, OSU, 1996b).

3.) Impurities, Adjuvant and Inert Ingredients in Herbicide Formations

During commercial synthesis of some pesticides, by products can be produced and carry over into the product eventually formulated for sale. Occasionally byproducts or impurities are considered toxicologically hazardous, and their concentrations must be limited so that potential exposures do not exceed levels of concern (Felsot, 2001).

Technical grade picloram (prior to mixing with other inert ingredients) and clopyralid contains hexachlorobenzene (HCB) as a byproduct of the synthesis of the active ingredients (USFS, 1999c). HCB is also a byproduct of chlorinated solvents used extensively in industry and occasionally around the home. HCB was registered as a fungicide until banned by EPA over concerns that it may be carcinogenic. As a result, Environmental Protection Agency has imposed a limit of 100 parts per million (ppm), HCB in Tordon®. The manufacturer of Tordon® has set its own manufacturing standards even lower and reportedly maintains HCB levels in formulated picloram at 50 ppm or less (i.e. 50 milligrams per liter of formulation). Average concentrations of HCB in picloram have been estimated at 8 ppm (US EPA, 1995). Therefore, HCB comprises on 0.000005 percent of the Tordon® formulation, which is then further diluted when the spray solution is prepared in accordance with the label.

Given the dilution of formulations by water in the final spray solution, estimates of HCB exposure from use of picloram or clopyralid containing products have shown that resulting residues in the environment and bystander exposure levels do no exceed current background levels. Longer-term dose estimates for the general public exposed to HCB in clopyralid were below the general background exposure to HCB in the environment by factors of about 25,000 to several million (USFS, 1999a). The central estimates of worker exposure to HCB under normal conditions were estimated to be lower than the background levels of exposure by factors of about 1,000. Likewise, the exposure assessments based on the use of picloram by the USFS have been estimated to result in long-term predictions for the general public that are below background doses of HCB due to environmental contamination by factors of about 1,400 to seven million (US FS, 1999a). Thus, for commercially sold products which are more dilute than technical grade products, there appears to be no basis for asserting that the use of clopyraid or picloram in accordance with the label by the Forest Service would result in substantial increases in the general exposure of either workers or members of the general public to HCB.

Another concern is potential presence of dioxin in formulations containing chlorinated chemicals. Dioxins are a group of chemicals involving 76 different types of related molecules called congeners, each having from two to eight chlorine atoms. The toxicity of each of the types of dioxin molecules is different. The toxic potency is determined by spatial arrangement of the chlorine atoms in a molecule rather than mere presence of chlorine. Of all of the congeners, one – TCDD (2,3,7,8-tetrachloro-para-dibenzodioxin), is the most potent. All other congeners are considered 10 to 10,000 times less potent than TCDD. Congeners with the greatest number of chlorine atoms are the least potent (Van den Berg *et al*., 1998).

TCDD and a few other dioxin congeners are byproducts of the synthesis of trichlorophenol. Most of the other dioxin congeners contain more chlorine than TCDD but are byproducts of the combustion of biomass (e.g., wood) and municipal waste. Dioxin congeners have always been in the environment as a result of natural fires and volcanic eruptions, and burning coal, wood, and gasoline (Alcock *et al*., 1998; Gribble, 1994). Thus, dioxin congeners are ubiquitous, but with the exception of TCDD, their potency is quite low and not of much toxicological concern (Safe, 1990).

TCDD is a byproduct of the active ingredient in 2,4,5-T. This herbicide was used as a mixture with 2,4-D to defoliate vegetation during the Vietnam War. In the past, a few imported formulations of 2,4-D were shown to contain some highly chlorinated dioxin congeners, the same congeners found in the environment and believed to be primarily the result of combustion processes. Compared to TCDD, the biological activity of the other congeners is low, and absent direct ingestion of these compounds in the diet, they are unlikely to be absorbed through the skin. Current quality control procedures during manufacturing have essentially eliminated any dioxin congeners of concern from domestic 2,4-D formulations. Thus, use of 2,4-D products manufactured in the U.S., whether at home or in agriculture and forestry, do not contaminate the environment with the dioxin congener of greatest regulatory concern, TCDD (US EPA, 1997; Chapter 8 of the Draft Dioxin Assessment).

The proprietary nature of herbicide formulations limits the understanding of the risks posed by inert ingredients and adjuvant in herbicide formulations. Unless the compound is classified as hazardous by the US Environmental Protection Agency, the manufacturer is not required to disclose its identity. It could be suggested that the inert ingredients in these herbicides are not toxic, or their toxicity would be reported to the Environmental Protection Agency. This would hold true if considerable toxicological testing of inert ingredients has been done. That, however, has not been the case. The Environmental Protection Agency is increasing the testing requirements for inert ingredients, but in many cases, the inert ingredients currently in use have not been tested rigorously and their toxicity is not well characterized. That being said, studies on the toxicity of technical grade formulations, which often contains the inert ingredients, account for the toxicity of the inert ingredients, and as has been reported here, these studies show that the use of herbicides by the Forest Service would not expose workers or the public to levels of concern.

Literature does report considerable information on types of inert ingredients and adjuvant present in herbicides proposed for use by the Forest. As noted in the Forest Service Risk Assessment (USFS, 1997b), Velpar L®, the trade name for hexazinone, contains 40-45 percent ethanol, and eye irritant and a considerable toxin if ingested. It has been reported the most common impurities of technical grade 2,4-D include other phenoxyacetic acids, a variety of chlorinated phenols, and possibly low levels of nitrosamines in amine salts (Ibrahim *et al.*, 1991). Transline, the commercial formulation of clopyralid contains clopyralid as the monoethanolamine salt and isopropyl alcohol, an approved food additive (USFS, 1999). Both Tordon22 and 22K contain the potassium slat of picloram (24.4 percent), the remaining consisting of polyglycol 26-2, the DOW name for polyethylene glycol, a widely used family of surfactants, considered to have low toxicity and frequently used in the formulation of ointments and cosmetics (MCCHB, 2001).

The Forest Service risk assessment (USFS, 1996c) reports that Garlon® formulations of triclopyr contain ethanol and kerosene. Technical formulations of imazapyr contain isopropyl alcohol and isopropanolamine slats of imazapyr (USFS, 1999b). Glyphosate has been reported to contain small amounts of nitrosamine, and N-nitroglyphosate (USFS, 1996d). Roundup, a formulation of glyphosate, contains the surfactant polyoxyethyleneamine, and contains 1,4-dioxame, classified by the US Environmental Protection Agency (US EPA) as a probable human carcinogen. However, carcinogenic studies of Roundup® by the US EPA have shown the herbicide to be non-carcinogenic (USFS, 1996a). The Forest Service (USFS, 2000) reports the inert ingredients in Escort®, which contains metsulfuron methyl, are confidential. They do report; however, the inert ingredients in Escort® are not classified by US EPA as toxic.

Many herbicide formulations contain dyes. The use of dyes can be beneficial in that they can color vegetation, making it less likely for an individual to inadvertently or un-intentionally consume contaminated vegetation. The presence of a dye in herbicide formulations may also make it easier for workers to see when they have been contaminated and allow for prompt remedial action.

Significant technological advances have been made with respect to dyes available for pesticide applicators. Several water soluble dyes of low toxicity are available, and their use can provide an added level of safety for the workers and the public. One such dye Hi-Light™ is currently used the Forest. This dye is non-toxic, dissolves quickly and thoroughly in water-based herbicides, and breaks down in sunlight or dissipates in rain, and therefore does not appreciable migrate from the point of used (Becker Underwood, 2003).

Surfactants are also commonly used in herbicide formulations. Surfactants are added to herbicides to improve herbicide mixing and the absorption or permeation of the herbicide into the plant. Like dyes and other inert ingredients, there is often limited information on the types of surfactants used and the toxicity of surfactants, especially since the industry considers the surfactant to play a key role in the effectiveness of the herbicide formulations. Most knowledge of surfactants is kept as proprietary information, and not disclosed. USFS (1997a), which attempted to assess the effects of surfactant formulations on the toxicity of glyphosate, reported that toxicity of glyphosate alone was about the same as the toxicity when mixed with surfactant, and greater than the toxicity of the surfactant alone. Whether this same pattern would hold true of other herbicides having the same or different surfactants is unknown. If so, the toxicological studies performed on herbicide formulations (which contain the inert ingredients and surfactants) may accurately portray the toxicity and risks posed to humans by the surfactant.

Endocrine Disruption

The endocrine system includes tissues and hormones that regulate metabolism, growth, and sexual development. The Food Quality Protection Act requires the Environmental Protection Agency to develop tests to screen for chemicals with the potential to mimic hormones. Chemicals that do mimic hormones and cause biochemical changes in tissues are called endocrine disrupters or hormonally active agents.

The concern over hormonally active agents is due to the fact that the endocrine system is intimately linked with the brain and the immune system. All three systems communicate with one another to affect body development and functioning. Adverse effects on this network have been blamed for a variety of maladies ranging from cancer to infertility to behavior problems (Felsot, 2001).

Chemicals, other than our own hormones, can interact with components of the endocrine system. Scientists have discovered that many kinds of chemicals, including natural food biochemicals as well as industrial chemicals and a few pesticides, can mimic the action of the hormones estrogen or testosterone. Concern has also been expressed about potential effects of the thyroid hormone during early development (Felsot, 2001).

Two general types of tests are used to screen chemicals of endocrine disrupting abilities. The most widely used tests are in-vitro tests. These tests are conducted in a test tube or dish using cells and in some cases the actual protein receptors, enzymes, and genes involved in the biochemistry of the endocrine system. In-vitro tests can be used to quickly screen large numbers of chemicals for their ability to interact with different biochemical components of the endocrine system.

Positive in-vitro tests, however, do not necessarily indicate that a substance would actually disrupt hormone functioning in a whole organism. In-vitro screening tests are properly used to determine which chemicals should be subjected to a second type of test, the in-vivo or “live animal” test. In-vivo tests use whole animals that are fed various doses of chemical. In some cases, the chemical is injected beneath the skin or directly into the body cavity. Developmental and reproductive toxicity studies with live animals over several generations are especially useful for determining if a substance adversely affects the endocrine system.

With one exception, the drug DES (diethylstilbesterol), all chemicals that have been tested in-vitro are thousands to millions of times less potent than the natural estrogen hormone (estradiol) (Felsot, 2001). Also, as exhibited by estradiol, all chemicals tested in-vitro, appear to show definitive threshold effects (i.e., NOEL) for estrogenic activity. No pesticides, food biochemic als, or other synthetic chemicals have definitively shown greater and/or different in-vitro effects at low doses as compared to higher doses. Although our natural hormones function at very miniscule levels in the body, endocrine disrupter tests have shown that interactions of hormone receptors with natural and synthetic chemicals are still related to dose during exposure. Even chemicals capable of interacting with the endocrine system at sufficiently high doses have not been found biologically active at low doses (US EPA, 1997).

In the in-vivo (live animal) studies to date, only a handful of chemicals, including natural food biochemicals, a few pesticides, and several industrial chemicals show endocrine disrupting effects (Felsot, 2001). The in-vivo experiments usually involve feeding pregnant rats or mice one or more doses of a chemical. With one exception, the drug DES, any effects that have been observed were in test with doses at least thousands of times greater than environmental or dietary concentrations.

In virtually all published cases where a series of doses are tested in-vivo, endocrine effects did no occur below some threshold dose (US EPA, 1997). The EPA concluded with exceptions (e.g. diethylstilbestrol) a causal relationship between exposure to a specific environmental agent and an adverse effect on human health operation via an endocrine disruption mechanism has not been established.

Chemically Sensitive Individuals

A small percentage of the population may have a hypersensitivity to a wider variety of pesticides, perfumes, household cleaners, construction products or industrial chemicals, including the herbicides proposed for us by the Forest. These people are generally aware of their sensitivities and would not be allowed to work on herbicide spray crews or in treated areas. Until either safe re-entry periods, or a period they feel is adequate based on their personal knowledge of their sensitivity, has passed. Safe re-entry in areas where herbicides have been applied is stated on the herbicide label and is generally when the herbicide has dried on the leaf surface. Hypersensitive individuals may also be subject to effects from gasoline engine exhaust, gasoline powered weed mowers, and automobiles used for invasive weed control and public used both in and outside the weed treatment areas.

Uncertainty

With exception of accidental exposures or exposures under very conservative and somewhat implausible exposure scenarios, workers and the general public should not be exposed to a herbicide at concentrations that result in an adverse health effects. This conclusion is predicated on forest service employees wearing appropriate personal protection, applying herbicides in accordance with the label, and implementing the job hazard analysis program to be used on this project. By doing so, possible exposure by contact or through drift would result in potential dose below that determined to be safe by the EPA over a lifetime of daily exposure. It is also predicated on the finding, back by toxicological studies, that a person can be exposed to some amount of a contaminant and not have an adverse effect (i.e. the dose determines the effect).

All of the herbicides proposed for use by the Forest must be registered for use by the EPA and the Montana Department of Agriculture. Registration of these herbicides and Federal regulations adopted to protect workers and the general public has required more scientific information and justification for use of herbicides. Nevertheless, there are many reports in the scientific literature and sections of this report that document associations between herbicide exposure and alterations of the immune system, autoimmune disorders, and increases in the probability of carcinogenesis. MCCHB (2001), Citron (1995), US EPA (1995), and Glover-Kerkvliet (1995) are just a few references that provide information on such effects. The body of literature on herbicide effects raises concerns about additive and synergistic effects of exposure to more than one herbicide, unstudied or unknown consequences of low=level chronic exposures, toxicity of inert ingredients, by-products or contaminants of herbicides, and uncertainties about the health effects of sensitive populations. There is also the realization that it is difficult, if no impossible, for government or any scientific agency to fully evaluate a chemical and all the potential combinations of them toe ensure that there would not be an adverse effect.

It would be inappropriate to suggest that use of herbicides to control noxious weeds is without risk to workers and the general public. If herbicides are used, there is the possibility of workers and general public exposure, no matter how many mitigation measures are implemented. All chemical exposure results in some level of health risk, the ris k primarily being a function of the dose, or amount a person or organism is exposed to over a period of time.

It is equally inappropriate to conclude that any exposure, regardless of dose, would result in an effect. It is easy to find a report showing a health effect caused by the exposure to a herbicide or any other chemical. The toxicological studies are purposely done using high doses to demonstrate an effect. It is the herbicides that show effects at low levels of e exposure or those levels anticipated when in use that should raise concern. With respect to this project, the potential dose received by the worker or the public does not approach the exposure levels shown to cause acute or chronic toxicity in the literature. Acute effects occur at doses thousands to tens of thousands of times higher than those estimated for the worker or public for this project. Likewise, chronic effects reportedly occur at does significantly higher than that expected for this project.

There are simply too many variables (receptor sensitivity, dose received, use of personal protection, etc.) for anyone to predict with 100 percent certainty the potential health risk of herbicide use and exposure. What is known is that through a process of continual review of toxicological data on herbicides, the Environmental Protection Agency (EPA), using very conservative assumptions, has determined a dose they believe would not result in an adverse health effect for herbicides proposed for use on this project. We know that there are studies which show that exposure to the herbicides proposed for use a high doses can cause deleterious effects. We also know that risk assessments have been completed to determine the estimated dose a worker or person of the general public might be exposed to under varying exposure scenarios. Most important, we know through a comparison of EPA established safe doses and estimated exposures that the estimated dose that people might be exposed to through use of a herbicides on this project would be below that determined to be safe by the EPA for a lifetime of daily exposure. Therefore, no health effects and risks to workers and the public are anticipated by the use of herbicides by the Forest.

Herbicide Drift

1.) Dynamics

Spray drift is largely a function of droplet particle size, release height, and wind speed (Teske and Thistle, 1999). Other factors that control drift, to a lesser degree, include the type of spray nozzle used, the angle of the spray nozzle, and the length of the boom. The largest particles, being the heaviest, would fall to the ground sooner than smaller sizes upon exiting the sprayer. Medium size particles can be carried beyond the sprayer swath (the fan shape spray under a nozzle), but all particles would deposit within a short distance of the release point. The physics of sprayers dictates that there would always be a small percentage of spray droplets small enough to be carried in wind currents to varying distances beyond the target area. Because the small droplets are a minor proportion of the total spray volume, their significance beyond field boundary rapidly declines as they are diluted in increasing volumes of air (Felsot, 2001).

Drift characteristics differ between pesticides. With herbicides proposed in this analysis, it is not critical to coat the entire leaf since some of the product can be absorbed by the plant roots and good efficacy can be achieved by larger droplets on leaves to the target plant. Therefore, herbicide drift can be intentionally reduced by generating larger droplets without reducing efficacy.

Spray nozzle diameter, pressure, amount of water in the tank mixture, and release height of the spray are important controllable determinants of drift potential by virtue of their effect on the spectrum of droplet sizes emitted from the nozzles (Felsot, 2001; Teske and Thistle, 1999). Meteorological conditions such as wind speed and direct, air mass stability, temperature and humidity and herbicide volatility also affect drift.

Commercial drift reduction agents are available that are designed to reduce drift beyond the capabilities of the determinants previously described. These products create larger and more cohesive droplets that are less apt to break into smaller particles as they fall through the air. They reduce the percentage of smaller lighter particles that are the size most apt to drift off the treatment area.

Wind speed increases the concentration of drifting droplets leaving the treated area if the wind is adverse (blowing away from the release point in the treatment area). If the wind is favorable (blowing into the treatment area) drift can be reduced. Numerous studies have shown that over 90 percent of spray droplets land on the target area, and about 10 percent or less move off-target, and that the droplets that move off-target most typically deposit within 100 feet of the target area (Felsot, 2001; Yates *et al.*, 1978; Robinson and Fox, 1978; Teske and Thistle, 1999).

2.) Herbicide Drift from Aerial Applications

Drift deposition on surfaces measured downwind from aerial spry sites is typically less than one percent, and often less than 0.1 percent, of on site deposition (Yates *et al.*, 1978; Robinson and Fox, 1978; Teske and Thistle, 1999). Drift deposition from ground equipment can be one-tenth of that from aerial application at comparable distances from a spray site (Yates *et al.*, 1978).

Less information is available on the concentrations of herbicides that remain airborne at greater distances from application sites. Robinson and Fox (1978) measured airborne concentrations of herbicides at various distances from aerial spray plots. Under conditions designed to reduce drift, these researchers did not detect airborne levels of herbicides beyond 100 feet downwind of 500 foot wide spray plots (detection limit of 0.1 microgram – there are about 28 million micrograms in an ounce).

These researchers also measured ambient air concentrations of 2,4-D at seven stations in eastern Washington where several million acres of wheat are treated with herbicides annually. Ambient concentrations of non-volatile fractions of 2,4-D typically averaged 0.1 to 0.2 milligrams/cubic meter during periods of heavy application. Imazapic and clopyralid, the herbicides most likely to be used by the Forest, are also non-volatile herbicides, and long-range drift of these compounds may exhibit similar dynamics as the non-volatile fractions of 2,4-D. Therefore, the ambient concentrations of imazapic or clopyralid from the proposed projects may be similar to the concentrations measured by Robinson and Fox.

Numerous investigations of factors affecting drift from aerial applications are reported in scientific literature (DiTomaso, 1999; Yates *et al*., 1978; Robinson and Fox 1978; Teske and Thistle, 1999; Teske *et al.*, 2000; Maybank *et al*., 1978). Three of the most comprehensive studies are discussed below.

3.) RAHUFS Drift Estimations

The 1992 Risk Assessment for Herbicide Use in Forest Service Regions 1, 2, 3, 4 and 10 and on Bonneville Power Administrations Sties (RAHUFS), determined spray drift distances downwind of an application site for aerial, back pack, and ground mechanical application equipment. The detailed methodology used in this study is included in USFS (1992). The results of RAHUFS spray drift analysis indicated “low” health risk to the public from ground and aerial applied herbicides. “Low risk” was defined in the study as drift from the herbicides that presents a less than one in a million systemic, reproduction or cancer risk. Spray drift from hand application equipment was found to be negligible.

4.) AGDRIFT / Felsot Drift Estimations

Felsot (2001) used the EPA/USDAFS AGDRIFT model to simulate herbicide sprays for several application scenarios, including a truck mounted spray boom set at two heights and a helicopter at two heights. These simulations included crosswinds blowing at ten and six mph. The model output was an estimated amount (percent of that applied) that deposited a defined distance from the edge of a spray swath. A spray deposition curve was developed to calculate a dose that a bystander could potentially receive if standing within the drift zone of an application. The whole body surface area was assumed exposed to drifting spray (highly conservative), and the bystanders ere assumed to be an adult weighing 70 kilograms and a child weighing 10 kilograms. Absorption of the depositing dose was assumed to be 10 percent. Calculations were made to determine the percentage of the depositing spray that a child could be exposed to on a daily basis over 70 year life span and be within the EPA safety guidelines as defined by the reference dose (i.e., the “safe dose”). The study estimated that for aerial application, the equivalent safe deposits corresponded to distances from the edge of the spray field of 0 and about 60 feet for clopyralid picloram, and 2,4-D. For a ground application, the child would receive a safe dose level of 2,4-d at 27 feet from the sprayed field edge.

5.) Mormon Ridge Field Drift Monitoring

In this study, herbicides were aerially applied with aircraft to the Mormon Ride winter range in 1997 and 1999. Mormon Ridge presented a difficult treatment scenario in that it is extremely steep, has rolling topography, considerable microclimate variability and aerial application occurred upslope of Mormon Creek, a bull trout –spawning stream. Mormon Creek flows along the bottom of the roughly three miles by ½ to ¾ - mile wide treatment area.

Picloram was aerial applied on Mormon Ridge in 1997. Buffer zones and water quality were monitored and continuous automated water samples collected. Analysis of the water samples (conducted by the Montana Department of Public Health and Human Services Chemistry Lab) indicated no herbicide entered the stream to a detection level of 0.1 parts per billion (USFS, 1996a). The Maximum Contamination Level as set by the EPA for drinking water is 500 parts per billion (Dow AgroSciences, 1999). No picloram was detected in Mormon Creek when tested at t level 5,000 times lower than the EPA Maximum Contamination Level. Drift cards were also placed along Mormon Creek to monitor drift. The cards indicated no detectable drift reached the creek.

The Mormon Ridge pilot project area was also aerial treated with picloram three growing seasons after the initial application to control invasive weeds that germinated from the soil seed bank after the herbicide decomposed. Drift cards used during this subsequent treatment did not detect picloram in the riparian aerial spray buffer.

6.) Spray Drift Summary

Based on the above information aerial herbicide applications would have a short-term, very localized impact as a result of drift. Most of the drift would settle to within 100-200 feet of the point of release in adverse conditions. Herbicide spray drift from aerial treatments under Alternative A would not significantly affect the health of the general public or adversely affect water quality, provided environmental protection measures are implemented to avoid drift toward persons and sensitive resources. Application should be made when there is an organized wind less than 6 mph blowing away from sensitive area. This practice combined with a buffer adjacent to sensitive areas and a drift reduction agent would likely result in no significant offsite drift. Significance in this context refers to concentrations above US EPA established “safe” levels.

Direct Effects, Alternative 1 (Proposed Action), Herbicides on Health Effects

Alternative 1 proposed to treat 458 acres with aerial spray, and up to 5390 ac with herbicides. Potential for public exposure to herbicides under Alternative 1 is low since most project areas are remote and away from population centers. Most of the ground based treatment sites are small weed patches along roadside edges. Once the herbicide dries on the plant there is little risk that the chemical will transfer to people or animals. When applied to vegetation the herbicides are very dilute, below the toxicity level of the chemical. When herbicides are use in campsites, the area will be posted notifying the public when the site was sprayed and when re-entry is safe (as defined by the product label, usually 24 to 48 hours).

Public exposure from aerial application is very low because the areas would be closed during application. Signs will be place in the area prior to aerial spraying and during re-entry period, and adjacent landowners will be notified in advance of aerial application. Ground crews will be onsite during spraying to verify that people are not in the area and to monitor spray conditions and drift cards. Aerial application would be prohibited when winds are greater than 6 mph; or blowing toward sensitive areas or private lands. Sensitive areas would be protected by the use of buffer zones (300 feet from all water with aerial treatments).

Even without mitigation measure, herbicide treatments (both aerial and ground) occur infrequently (aerial treatment once every three years if needed, ground treatments once per year) and the public would not receive daily exposures above the US EPA reference doses, a dose considered safe by the EPA over a lifetime of daily exposure. No adverse health effects are anticipated for the general public based on estimates of exposure, estimates of drift, and the mitigation measures that would be implemented under this alternative. .

Potential for workers to be exposed to herbicides would be high because most of the work will be completed with ground-based applications. The more time spent applying a herbicide the greater the risk of a spill, accident or mishap. Mitigations that require the workers to use personal protective equipment when working with herbicides will minimize risk of exposure application or an accident.

Direct Effects, Alternative 2 (No Herbicides), Herbicides on Health Effects

Since herbicides will not be used in this alternative there will be no health risk from herbicides. However, there will be a continued increase in weed spread and consequently an increase in weed pollen. People with allergies to these weed species will be affected.

Direct Effects, Alternative 3 (No Change from Current Management), Herbicides on Health Effects

Under this alternative weeds would continue to spread on the Forest. People with allergies, asthma and minor skin irritations caused by certain weed would be affected. Herbicides would be use on 346 acres, but the general public would not be exposed to herbicides at doses that are considered toxic.

Direct Effects, Alternative 4(No Aerial Application) Herbicides on Health Effects

Alternative 4 is the same as Alternative 1 except for 255 acres of aerial treatment that would be treated with backpack sprayers, biological control agents or not treated in any manner. Since the amount of herbicide being used is very similar to Alternative 1 there is no measurable difference, in terms of exposure or risk to human health, between these two alternatives.

Cumulative Effects to Human Environment

Past, present and reasonably foreseeable activities that may have cumulative effects on human health include weed control efforts on adjacent private and public lands. Based on the results of risk assessments performed by the Forest Service, the ongoing and future activities are not expected to result in exposures to workers and the general public at doses that exceed the reference dose. Therefore, under Alternatives 1, 3 and 4, no cumulative adverse health effects are anticipated for workers and the general public, provided herbicides are applied in accordance with the label as proposed. There are no anticipated cumulative health effects associated with biological, mechanical, or cultural treatment of weeds.

Inherent to having confidence in these conclusions is an understanding of what a reference dose is (how safe it is) and how it is determined. The Environmental Protection Agency (EPA) develops reference doses for chemicals including the herbicides proposed for use by the Forest Service. The reference dose is defined by the EPA as an estimate of daily dose over a 70-year life span that a human can receive without an appreciable risk of deleterious effects. A reference dose is determined by subjecting animals to exposures of a substance and determining the Lowest Observable Effects Level (LOEL) and the No Observable Effects Level (NOEL) from the entire body of scientifically supported animal studies performed for that substance. The NOEL represents the dose the EPA believes would not result in an effect. Reference dose calculated by dividing the NOEL, a level or dose already thought to not cause an effect, by a “safety factor” usually 100, to account for extrapolation of animal data to humans and sensitive individuals. Therefore the reference dose for a chemical is a dose at least 100 times lower than that shown to have an effect in any animal study performed with the subject chemical. With respect to herbicide applications, it has been estimated in nearly all cases that the dose a worker or a person of the general public would be exposed to would be below the reference dose, except for somewhat implausible exposure scenarios (spray over entire naked body, or wearing heavily contaminated gloves for an extended period).

Consistency with Forest Plan and other Laws, Regulations and Policies

All alternatives are consistent with Environmental Protection Agency, Occupational Health and Safety Administration, and Forest Service regulations regarding pesticide use and worker safety.

POSSIBLE CONFLICT WITH OTHER PLANS AND POLICIES

Montana noxious weed laws direct County control authorities to make all reasonable efforts to develop and implement a noxious weed program. The lack of adequate weed control under the No Change from Current Management Alternative (Alternative 3) and No Herbicide Alternative (Alternative 2) would conflict with these State and County weed control plans and policies. Alternatives 1 and 4 indicate that the Forest Service is committed to the management of noxious and undesirable weeds in the Gallatin National Forest.

None of the alternatives would conflict with State and Federal water or air quality regulations or with US. Fish and Wildlife Service recovery plans for threatened and endangered species. A biological assessment of potential effects of the preferred alternative of potential effects of the preferred alternative to threatened and endangered species will be completed for the final EIS.